
Chemistry

Master's and Doctoral Programs

www.asu.edu/clas/chemistry

480/965-4664

PS D102A

George H. Wolf, Assistant Chair for Graduate Studies

Regents' Professors: Angell, Buseck, Pettit

Professors: Allen, Blankenship, Fromme, Fuchs, Gust, Holloway, Kouvetakis, Lindsay, Lohr, A. Moore, T. Moore, Petuskey, Rose, Shock, Skibo, Steimle, Thorpe, Williams, Woodbury

Associate Professors: Booksh, Hayes, Wolf

Assistant Professors: Caudle, Francisco, Ghirlanda, Gould, Matyushov, Richert, Seo, Wachter

The faculty in the Department of Chemistry and Biochemistry offer programs leading to the M.S. and the Ph.D. degrees in Chemistry. Areas of concentration include analytical chemistry, biochemistry, geochemistry, inorganic chemistry, organic chemistry, physical chemistry, and solid-state chemistry.

The faculty also participate in offering programs leading to the Master of Natural Science degree when one of the concentrations is chemistry (see "Natural Science," page 287), and the interdisciplinary programs, leading to the Ph.D. degrees with majors in Exercise Science (see "Exercise and Wellness," page 218) and the Science and Engineering of Materials (see "Science and Engineering of Materials," page 320).

Students admitted to the Master of Education degree program with a major in Secondary Education may also elect chemistry as the subject matter field.

The graduate programs offered by the faculty in the Department of Chemistry and Biochemistry prepare students for professional careers in chemistry and related fields in industry, government, and educational institutions. All students applying for admission to one of these programs must submit scores for the Graduate Record Examination.

MASTER OF SCIENCE

See "Master's Degrees," page 94, for general requirements.

Program of Study. A minimum of 30 semester hours of credit is required. A thesis carrying six semester hours is also included in the total. The remaining courses are selected by the student in consultation with the supervisory committee.

Thesis Requirements. A thesis is required.

Final Examinations. A general oral examination is required of all candidates for the master's degree. A written examination may also be required.

DOCTOR OF PHILOSOPHY

See "Doctor of Philosophy," page 96, for general requirements.

Program of Study. A minimum of 84 semester hours, including dissertation, is required. Approximately 20 to 30 hours of this total is formal course work. Courses, including research and dissertation, are selected by the student in consultation with the supervisory committee.

Cumulative Examinations. Written examinations are required. In addition, an oral examination is required which includes material of a general nature, and the presentation and defense of current research and an original research proposal prepared by the student.

Foreign Language Requirements. There is no departmental foreign language requirement, but the student's supervisory committee may specify a reading proficiency in one or more foreign languages.

Dissertation Requirements. A dissertation based on original work of high quality and demonstrating proficiency in the student's special field is required. (See "Research and Dissertation Requirements," page 98.)

Final Examination. The final oral examination is a defense of the dissertation, during which the candidate presents a summary of the dissertation research. Evidence of a publishable contribution of original research must be presented.

BIOCHEMISTRY (BCH)

BCH 461 General Biochemistry. (3)

fall

Structure, chemistry, and metabolism of biomolecules and their role in the biochemical processes of living organisms. Credit is allowed for only BCH 461 or 361. Prerequisite: CHM 318 or 332. Corequisite: CHM 341 or 346.

BCH 462 General Biochemistry. (3)

spring

Continuation of BCH 461. Prerequisite: BCH 461 or instructor approval.

BCH 463 Biophysical Chemistry. (3)

spring

Principles of physical chemistry as applied to biological systems. Prerequisite: CHM 341 or 346.

BCH 465 Protein and Nucleic Acid Biochemistry. (3)

spring

Structure and function of proteins and nucleic acids, including protein folding, enzymology, proteomics, DNA/RNA structure, replication, transcription, and genomics. Prerequisite: BCH 461.

BCH 467 Analytical Biochemistry Laboratory. (3)

spring

Quantitative analysis, separation and purification of biological molecules. Applies chemical and physical methods to the characterization of biological macromolecules. 1 conference, 1 hour lecture, 5 hours lab. Prerequisite: BCH 461. Corequisite: BCH 462.

BCH 501 Current Topics in Biochemistry. (1)

fall and spring

May be repeated for credit. Seminar. Prerequisite: instructor approval.

BCH 561 Advanced Topics in Biochemistry. (3)

spring

Topics selected from emerging areas of biochemistry based primarily on current literature. Prerequisite: BCH 462.

BCH 563 Biophysical Chemistry. (3)*selected semesters*

Physical chemistry of macromolecules, especially proteins, nucleic acids, and polysaccharides. Thermodynamics, hydrodynamics, and spectroscopy of and their relation to structure. Prerequisites: BCH 462; CHM 346.

BCH 568 Molecular Mechanisms of Photosynthesis. (3)*spring*

Structure and function of photosynthetic complexes; mechanism of energy conversion in plants, bacteria, and model systems. Cross-listed as PLB 558. Credit is allowed for only BCH 568 or PLB 558. Prerequisite: instructor approval.

Omnibus Courses. For an explanation of courses offered but not specifically listed in this catalog, see "Omnibus Courses," page 50.

CHEMISTRY (CHM)**CHM 424 Separation Science. (3)***selected semesters*

Basic theory and practical aspects of gas, liquid, ion-exchange, and gel-permeation chromatographies, and other important industrial and research techniques. 2 hours lecture, 4 hours lab. Fee. Prerequisite: CHM 318 or 332 or 346 or instructor approval.

CHM 431 Qualitative Organic Analysis. (3)*spring*

Systematic identification of organic compounds. 1 hour lecture, 6 hours lab. Fee. Prerequisites: both CHM 118 (or 327) and 320 (or 336) or only instructor approval.

CHM 435 Medicinal Chemistry. (3)*spring*

Principles of medicinal and pharmaceutical chemistry. Drug design, synthesis, and mechanism of action. Prerequisites: a combination of BCH 361 (or 461) and BIO 353 and CHM 318 (or 332) or only instructor approval.

CHM 452 Inorganic Chemistry Laboratory. (1–2)*spring*

Preparation and characterization of typical inorganic substances, emphasizing methods and techniques. 1 conference, 5 hours lab. Fee. Prerequisite: instructor approval.

CHM 453 Inorganic Chemistry. (3)*fall*

Principles and applications of inorganic chemistry. Prerequisite: CHM 341 or 346.

CHM 460 Biological Chemistry. (3)*spring*

Structure and function of macromolecules and their involvement in the processing of energy and information by living cells. Prerequisites: CHM 318, 346, 453.

CHM 471 Solid-State Chemistry. (3)*fall*

Crystal chemistry, thermodynamics and electrochemistry of solids, nonstoichiometric compounds, diffusion and solid-state reactions, crystal growth, and selected topics. Pre- or corequisite: CHM 346 or instructor approval.

CHM 480 Methods of Teaching Chemistry. (3)*spring*

Organization and presentation of appropriate content of chemistry; preparation of reagents, experiments, and demonstrations; organization of stock rooms and laboratories; experience in problem solving. Fee. Prerequisite: instructor approval.

CHM 481 Geochemistry. (3)*spring*

Origin and distribution of the chemical elements. Geochemical cycles operating in the earth's atmosphere, hydrosphere, and lithosphere. Cross-listed as GLG 481. Credit is allowed for only CHM 481 or GLG 481. Prerequisite: CHM 341 (or 346) or GLG 321.

CHM 483 Astrobiology. (3)*fall and spring*

Origin, early evolution, distribution, and future of life on Earth and elsewhere in the cosmos. May be repeated for credit. Lecture, discussion, video conferences, possible field trips. Cross-listed as AST 460/ BIO 460/GLG 460/MIC 475. Credit is allowed for only AST 460 or BIO 460 or CHM 483 or GLG 460 or MIC 475. Prerequisite: instructor approval.

CHM 485 Meteorites and Cosmochemistry. (3)*selected semesters*

Chemistry of meteorites and their relationship to the origin of the earth, solar system, and universe. Cross-listed as GLG 485. Credit is allowed for only CHM 485 or GLG 485.

CHM 494 Special Topics. (1–4)*selected semesters*

Topics may include the following:

- Chemistry of Global Climate Change. (3)

CHM 501 Current Topics in Chemistry. (1)*fall and spring*

May be repeated for credit. Prerequisite: instructor approval.

CHM 521 Chemometrics. (3)*selected semesters*

Overview of chemometric tools in analytical chemistry, including multivariate calibration, spectral deconvolution, and experimental design. 2 hours lecture, 4 hours lab.

CHM 523 Advanced Analytical Chemistry. (3)*once a year*

Theoretical principles of analytical instrumentation and measurements. Prerequisites: both CHM 325 and 346 or only instructor approval.

CHM 524 Separation Science. (3)*selected semesters*

Addresses principles and applications for all areas of chemical separations. Emphasizes separations principles in microfluidics and its interface with nanotechnology and traditional electronic materials. 2 hours lecture, 4 hours lab.

CHM 525 Analytical Spectroscopy. (4)*spring*

Theoretical and practical considerations involving the use of optical instruments for chemical analyses. 3 hours lecture, 3 hours lab. Prerequisite: CHM 346 or instructor approval.

CHM 526 X-Ray Methods of Analysis. (4)*selected semesters*

Theoretical and practical considerations involving the use of x-ray diffraction and spectroscopy for chemical and structural analyses. 3 hours lecture, 3 hours lab. Prerequisite: CHM 346.

CHM 527 Electroanalytical Chemistry. (4)*selected semesters*

Theoretical and practical considerations for modern electroanalytical chemistry, including voltammetry, potentiometry, and microelectrode analysis. 2 hours lecture, 6 hours lab. Prerequisite: CHM 346.

CHM 531 Advanced Organic Chemistry I. (3)*fall*

Reaction mechanisms, reaction kinetics, linear free energy relationships, transition state theory, molecular orbital theory, and Woodward-Hoffmann rules. Prerequisites: CHM 318 (or 332), 346.

CHM 532 Advanced Organic Chemistry II. (3)*spring*

Organic mechanisms, thermodynamic and kinetic control, structure/activity relationships, isotope effects, multistep reactions, reactive intermediates, radical reactions, electron transfer. Prerequisite: CHM 531.

CHM 535 Medicinal Chemistry. (3)*spring*

Principles of medicinal and pharmaceutical chemistry. Drug design, synthesis, and mechanism of action. Prerequisites: a combination of BCH 361 (or 461) and BIO 353 and CHM 318 (or 332) or only instructor approval.

CHM 537 Organic Reactions. (3)*spring*

Organic synthetic methodologies and important synthetic reactions emphasizing recently discovered reactions of preparative value. Protection/deprotection synthetic strategies; peptide synthesis. Prerequisite: CHM 531.

CHM 541 Advanced Thermodynamics. (3)*fall*

Equilibrium thermodynamics. Chemical reactions, phase equilibria, and stability in multicomponent systems. Aqueous solutions and electrochemistry. Introduction to statistical thermodynamics. Prerequisite: CHM 346.

GRADUATE PROGRAMS AND COURSES

CHM 543 Computational Chemistry. (3)

selected semesters

Provides basic concepts and practical experience in computational chemistry. Covers electronic structure methods and computer simulation techniques. Prerequisite: CHM 345 or 545.

CHM 545 Quantum Chemistry. (3)

spring

Wave and matrix formulation of quantum mechanics applied to the vibrational, rotational, and electronic states of polyatomic molecules. Hartree-Fock, electron correlation, and molecular orbital theory. Selection rules and introduction to group theory. Prerequisite: CHM 346.

CHM 546 Molecular Spectroscopy and Group Theory. (3)

spring

Applies quantum mechanics to the general problem of the interaction of light with molecular systems. Angular momentum and group theory. Symmetry classifications. Overview of the formalism and experimental techniques in different resonant-based spectroscopies. Prerequisite: CHM 545.

CHM 548 Chemical Kinetics and Dynamics. (3)

spring in odd years

Experimental and theoretical aspects of time-dependent processes in chemistry. Topics include kinetics of chemical reactions, diffusion, and relaxation phenomena in ordered and disordered materials. Prerequisite: CHM 545.

CHM 549 Advanced Topics in Physical Chemistry. (3)

selected semesters

Various advanced and special topics in physical chemistry. Previous topics included: supercooled liquids and the glass transition, vibrational spectroscopy of solids, phase transitions and critical phenomena. May be repeated for credit. Prerequisite: CHM 345 or 545.

CHM 552 Advanced Inorganic and Materials Synthesis Laboratory. (2)

fall

Preparation and characterization of inorganic compounds and materials, emphasizing advanced methods and techniques of importance in inorganic and materials chemistry. Schlenk-line and glovebox manipulations, solvothermal syntheses, and gas-phase reactions. Lab. Prerequisites: CHM 345; instructor approval. Pre- or corequisite: CHM 453 or instructor approval.

CHM 553 Advanced Inorganic Chemistry. (3)

fall

Principles of modern inorganic chemistry applied over the entire periodic system. Bonding theory, chemical reactivity, spectroscopic and magnetic properties. Prerequisites: CHM 345, 346, 453.

CHM 571 Structure, Bonding, and Symmetry in Materials. (3)

fall

Principles of structural and materials chemistry, emphasizing crystal chemistry. Symmetry of periodic structures (space groups), factors determining bond lengths and coordination geometries, and the role of structure in determining physical properties.

CHM 579 Topics in Inorganic and Materials Chemistry. (3)

selected semesters

Various advanced and special topics in inorganic and materials chemistry. May be repeated for credit. Prerequisite: instructor approval.

CHM 582 Topics in Geochemistry and Cosmochemistry. (3)

selected semesters

Topics of current interest for students in chemistry and other fields. Sampling of data and thought concerning phase equilibria, element distribution, meteorites, the Earth, and other planets. May be repeated for credit. Prerequisite: instructor approval.

CHM 583 Phase Equilibria and Geochemical Systems. (3)

selected semesters

Natural reactions at high temperatures and pressures; silicate, sulfide, and oxide equilibria. Prerequisite: instructor approval.

CHM 593 Applied Project. (1-12)

selected semesters

Topics may include the following:

- Glass Blowing
Fee.

CHM 598 Special Topics in Organic Chemistry. (1-4)

selected semesters

Topics may include the following:

- Biological Photochemistry. (3)
Photochemistry and photophysics of pigment molecules. Emphasizes photobiological processes. Topics may include: dipole transition moment, electronic structure and relaxation of excited states, time-resolved spectroscopy, excimers, charge-transfer complexes and exciplexes, photoinduced energy and electron transfer, photoisomerization in vision, photochemistry of DNA.
- Bioorganic Chemistry. (3)
- Organic Photochemistry. (3)
- Organic Problems. (3)
- Special Topics in Organic Chemistry. (3)

fall

Two topics selected from and rotating among the following: NMR spectroscopic techniques as applied to organic problems, medicinal chemistry, bioorganic chemistry, organic photochemistry, and supramolecular chemistry.

- Supramolecular Chemistry. (3)

May be repeated for credit. Prerequisite: instructor approval.

Omnibus Courses. For an explanation of courses offered but not specifically listed in this catalog, see "Omnibus Courses," page 50.

Civil Engineering

Master's and Doctoral Programs

www.eas.asu.edu/~civil

480/965-3589

ECG 252

Sandra L. Houston, Chair

Richard Snell Presidential Chair Professor: Crittenden

Professors: Fox, Houston, Johnson, Mamlouk, Mays, Rajan, Singhal, Witczak

Associate Professors: Abbaszadegan, Fafitis, Hinks, Mobasher, Muccino, Westerhoff

Assistant Professors: Allen, Dillner, Kaloush, Owusu-Antwi, Peccia

Research Faculty: Alum, Esparza-Soto, Febres, Hokanson, Lee, Mash, Zapata

The faculty in the Department of Civil and Environmental Engineering offer graduate programs leading to the M.S., the Master of Science in Engineering (M.S.E.), and the Ph.D. degrees in Civil Engineering.

The faculty also participate in offering the Tri-University Master of Engineering degree program. See "Master of Engineering—M.Eng.," page 204, for program description.

Graduate Record Examination. Submission of Graduate Record Examination (GRE) scores, general test, is required for all degree-seeking applicants.

TOEFL Examination. International applicants, whose native language is not English, are required to have taken

the Test of English as a Foreign Language (TOEFL), and achieved a minimum score of 550.

MASTER OF SCIENCE

See “Master’s Degrees,” page 94, for general requirements.

MASTER OF SCIENCE IN ENGINEERING

See “Master of Science in Engineering,” page 204.

DOCTOR OF PHILOSOPHY

The Ph.D. degree is conferred upon students based on evidence of excellence in research leading to a scholarly dissertation that is a contribution to knowledge in the field of civil engineering. See “Doctor of Philosophy,” page 96, for general requirements.

Letters of Recommendation. Submission of three letters of recommendation is required for those applying for admission to the Ph.D. degree program. One letter must be from the chair or advisor of the applicant’s previous degree program.

Program of Study. The program of study must be prepared soon after a student has been admitted to the program, a supervisory committee has been formed, and a preliminary examination (if required by the supervisory committee) has been taken.

Foreign Language Requirements. None.

Comprehensive Examinations. Written and oral comprehensive examinations are required. The examinations are administered by the supervisory committee. Students should request permission from the Graduate College to take the examinations when they have essentially completed the course work in their approved program of study.

Dissertation Requirements. A dissertation based on original work demonstrating creativity in research and scholarly proficiency in the subject area is required.

Final Examination. A final oral examination in defense of the dissertation is required.

RESEARCH ACTIVITY

A broad range of theoretical and experimental research programs have been established in civil and environmental engineering to prepare graduate students for careers in professional practice and research. These programs are constantly evolving with the changes in society and the profession, and many are multidisciplinary in nature.

Experimental and theoretical research conducted by the civil and environmental engineering faculty and students is carried out in the specialized areas of construction engineering, environmental engineering, geotechnical/geoenvironmental engineering, structures/materials engineering, transportation/materials engineering, and water resources engineering. For more information about these activities, access the Web site at www.eas.asu.edu/~civil.

Areas of Study

Areas of study in the civil and environmental engineering curriculum are described below.

Construction Engineering. This area of study includes the analysis, design, and construction of civil engineering structures; construction materials and practice; quality control; and civil engineering project management.

Environmental Engineering. This area of study includes water and wastewater treatment; water reuse and water resource sustainability; chemical and microbial pollutant identification, monitoring, and transport/fate modeling; and chemical and microbial inactivation and removal.

Geotechnical/Geoenvironmental Engineering. This area of study includes the analysis and design of foundation systems, seepage control, earthdams and water resource structures, earthwork operations, fluid flow-through porous media, response of foundations and embankments to earthquakes, and solutions to environmental problems.

Structures/Materials Engineering. This area of study considers the planning, analysis, and design of steel and concrete bridges, buildings, dams; special offshore and space structures; Portland cement concrete; composite materials; and structural retrofit of existing bridges.

Transportation/Materials Engineering. This area of study includes (1) transportation design and operation, and (2) pavements and materials. Transportation design and operation covers geometric design of highways, traffic operations, and highway capacity and safety. Pavements and materials focuses on pavement analysis and design, pavement maintenance and rehabilitation, pavement evaluation and management, characterization of highway materials, and durability of highway structures.

Water Resources Engineering. This area of study is concerned with surface and groundwater flow, planning and management of water supply, and water distribution system modeling.

CIVIL AND ENVIRONMENTAL ENGINEERING (CEE)

CEE 423 Structural Design. (3)

fall

Analysis and design of reinforced concrete steel, masonry, and timber structures. Fee. Prerequisite: CEE 421. Pre- or corequisite: CEE 420.

CEE 440 Engineering Hydrology. (3)

fall

Descriptive hydrology; hydrologic cycle, models, and systems. Rain-runoff models. Hydrologic design. Concepts, properties, and basic equations of groundwater flow. Prerequisite: CEE 341.

CEE 441 Water Resources Engineering. (3)

spring

Applies the principles of hydraulics and hydrology to the engineering of water resources projects; design and operation of water resources systems; water quality. Prerequisite: CEE 341.

CEE 452 Foundations. (3)

fall

Applies soil mechanics to foundation systems, bearing capacity, lateral earth pressure, and slope stability. Prerequisite: CEE 351.

CEE 466 Sanitary Systems Design. (3)

fall

Capacity, planning and design of water supply, domestic and storm drainage, and solid waste systems. Prerequisite: CEE 361.

GRADUATE PROGRAMS AND COURSES

CEE 474 Transportation Systems Engineering. (3)

fall

Introduces transportation systems and modeling, traffic characteristic analysis, traffic predictions, highway capacity, signal timing, transportation systems management, and transit. Prerequisites: CEE 372; ECE 384.

CEE 475 Highway Geometric Design. (3)

spring

Design of the visible elements of the roadway. Fundamental design controls with application to rural roads, at-grade intersections, free-ways, and interchanges. Lecture, computer lab. Fee. Prerequisite: CEE 372.

CEE 486 Integrated Civil Engineering Design. (3)

fall and spring

Requires completion of a civil engineering design in a simulated practicing engineering environment. Limited to undergraduates in their final semester. Lecture, team learning. Prerequisites: CEE 321, 341, 351, 361, 372.

CEE 511 Pavement Analysis and Design. (3)

fall

Design of flexible and rigid pavements for highways and airports. Surface, base, and subgrade courses. Cost analysis and pavement selection. Credit is allowed for only CEE 511 or 412. Prerequisites: CEE 351; ECE 351.

CEE 512 Pavement Performance and Management. (3)

selected semesters

Pavement management systems, including data collection, evaluation, optimization, economic analysis, and computer applications for highway and airport design. Prerequisite: instructor approval.

CEE 514 Bituminous Materials and Mixture. (3)

selected semesters

Types of bituminous materials used in pavement mixtures. Chemical composition, physical properties, desirable aggregate characteristics, optimum asphalt contents, superpave asphalt binder, mixture design. Lecture, lab. Fee. Prerequisite: ECE 351.

CEE 515 Properties of Concrete. (3)

selected semesters

Materials science of concrete. Cement chemistry, mechanisms of hydration, interrelationships among micro- and macro-properties of cement-based materials. Mechanical properties, failure theories, fracture mechanics of concrete materials. Cement-based composite materials and the durability aspects. Lecture, lab. Fee. Prerequisite: ECE 350 or 351.

CEE 521 Stress Analysis. (3)

fall

Introduces tensors: kinematics, stress analysis, and constitutive assumptions leading to elastic and plastic behavior. Strain energy and energy methods; applications. Cross-listed as MAE 520. Credit is allowed for only CEE 521 or MAE 520.

CEE 522 Experimental Stress Analysis. (3)

selected semesters

Specification and analysis of stress and strain at a point, stress-strain relationships. Mechanical, optical, and electrical strain gages and circuits, digital data acquisition and analysis, closed loop mechanical testing, fracture mechanics, optical methods and photoelasticity, and introduction to nondestructive testing. Lecture, lab.

CEE 524 Advanced Steel Structures. (3)

fall

Strength properties of steel and their effects on structural behavior. Elastic design of steel structures. Plastic analysis and design of beams, frames, and bents. Plastic deflections. Plastic design requirements. Multistory buildings. Prerequisite: CEE 420.

CEE 526 Finite Elements for Engineers. (3)

fall

Direct stiffness, method of weighted residuals, weak formulation, and variational techniques in the solution of engineering problems. Cross-listed as MAE 527. Credit is allowed for only CEE 526 or MAE 527. Prerequisite: CEE 432 or MAE 404 (or their equivalents).

CEE 527 Advanced Concrete Structures. (3)

selected semesters

Ultimate strength design. Combined shear and torsion. Serviceability. Plastic analysis. Special systems. Prerequisite: CEE 421.

CEE 530 Prestressed Concrete. (3)

selected semesters

Materials and methods of prestressing. Analysis and design for flexure, shear, and torsion. Prestress losses due to friction, creep, shrinkage, and anchorage set. Statically indeterminate structures. Design of flat slabs, bridges, and composite beams. Prerequisite: CEE 421.

CEE 532 Developing Software for Engineering Applications. (3)

spring

Matrix and computer applications to structural engineering and structural mechanics. Stiffness and flexibility methods, finite elements, and differences. Credit is allowed for only CEE 532 or 432. Prerequisite: CEE 321.

CEE 533 Structural Optimization. (3)

selected semesters

Linear and nonlinear programming. Problem formulation. Design sensitivity analysis. FEM-based optimal design of structural and mechanical systems. Cross-listed as MAE 521. Credit is allowed for only CEE 533 or MAE 521. Prerequisites: ASE 582; CEE 526 (or MAE 527).

CEE 536 Structural Dynamics. (3)

selected semesters

Free vibration and forced response of discrete and continuous systems, exact and approximate methods of solution, response spectra, computational techniques, special topics. Lecture, recitation. Cross-listed as MAE 515. Credit is allowed for only CEE 536 or MAE 515.

CEE 537 Topics in Structural Engineering. (1–3)

selected semesters

Advanced topics, including nonlinear structural analysis, experimental stress analysis, advanced finite elements, plasticity and viscoelasticity, composites, and damage mechanics. Prerequisite: instructor approval.

CEE 540 Groundwater Hydrology. (3)

selected semesters

Physical properties of aquifers, well pumping, subsurface flow modeling, unsaturated flow, numerical methods, land subsidence, and groundwater pollution. Prerequisite: CEE 440 or instructor approval.

CEE 541 Surface Water Hydrology. (3)

selected semesters

Hydrologic cycle and mechanisms, including precipitation, evaporation, and transpiration; hydrograph analysis; flood routing; statistical methods in hydrology and hydrologic design. Prerequisite: CEE 440 or instructor approval.

CEE 543 Water Resources Systems. (3)

selected semesters

Theory and application of quantitative planning methodologies for the design and operation of water resources systems. Class projects using a computer, case studies. Prerequisite: instructor approval.

CEE 546 Free Surface Hydraulics. (3)

selected semesters

Derivation of 1-D equations used in open channel flow analysis; computations for uniform and nonuniform flows, unsteady flow, and flood routing. Mathematical and physical models. Prerequisite: CEE 341.

CEE 547 Principles of River Engineering. (3)

selected semesters

Uses of rivers, study of watershed, and channel processes. Sediment sources, yield, and control; hydrologic analysis. Case studies. Prerequisite: CEE 341 or instructor approval.

CEE 548 Sedimentation Engineering. (3)

selected semesters

Introduces the transportation of granular sedimentary materials by moving fluids. Degradation, aggregation, and local scour in alluvial channels. Mathematical and physical models. Prerequisite: CEE 547 or instructor approval.

CEE 550 Soil Behavior. (3)

selected semesters

Physicochemical aspects of soil behavior, stabilization of soils, and engineering properties of soils. Prerequisite: CEE 351.

CEE 551 Advanced Geotechnical Testing. (3)

selected semesters

Odometer, triaxial (static and cyclic) back pressure saturated and unsaturated samples, pore pressure measurements, closed-loop computer-controlled testing, in-situ testing, and sampling. Lecture, lab. Fee. Prerequisite: CEE 351.

CEE 553 Advanced Soil Mechanics. (3)

selected semesters

Applies theories of elasticity and plasticity to soils, theories of consolidation, failure theories, and response to static and dynamic loading. Prerequisite: CEE 351.

CEE 554 Shear Strength and Slope Stability. (3)

selected semesters

Shear strength of saturated and unsaturated soils strength-deformation relationships, time-dependent strength parameters, effects of sampling, and advanced slope stability. Prerequisite: CEE 351.

CEE 555 Advanced Foundations. (3)

selected semesters

Deep foundations, braced excavations, anchored bulkheads, reinforced earth, and underpinning. Prerequisite: CEE 351.

CEE 556 Seepage and Earth Dams. (3)

selected semesters

Transient and steady-state fluid flow through soil, confined and unconfined flow, pore water pressures, and application to earth dams. Prerequisite: CEE 351.

CEE 557 Hazardous Waste: Site Assessment and Mitigation Measures. (3)

selected semesters

Techniques for hazardous waste site assessment and mitigation. Case histories presented by instructor and guest speakers. Prerequisites: graduate standing; instructor approval.

CEE 559 Earthquake Engineering. (3)

selected semesters

Characteristics of earthquake motions, selection of design earthquakes, site response analyses, seismic slope stability, and liquefaction. Prerequisite: CEE 351.

CEE 560 Soil and Groundwater Remediation. (3)

selected semesters

Techniques for remediation of contaminated soils and groundwaters with basic engineering principles. Prerequisite: instructor approval.

CEE 561 Physical-Chemical Treatment of Water and Waste. (3)

selected semesters

Theory and design of physical and chemical processes for the treatment of water and wastewaters. Prerequisite: CEE 361.

CEE 562 Environmental Biochemistry and Waste Treatment. (3)

selected semesters

Theory and design of biological waste treatment systems. Pollution and environmental assimilation of wastes. Prerequisite: CEE 362.

CEE 563 Environmental Chemistry Laboratory. (3)

selected semesters

Analyzes water, domestic and industrial wastes, laboratory procedures for pollution evaluation, and the control of water and waste treatment processes. Lecture, lab. Fee. Prerequisite: CEE 361.

CEE 564 Contaminant Fate and Transport. (3)

selected semesters

Fate and transport processes with emphasis on governing equations and parameters relevant to the migration of chemicals in the environment. Prerequisite: CEE 361.

CEE 565 Modeling and Assessment of Aquatic Systems. (3)

selected semesters

Development of predictive models of water quality; methods to assess environmental impacts; applications to water quality management. Prerequisite: CEE 361 or instructor approval.

CEE 566 Industrial/Hazardous Waste Treatment. (3)

selected semesters

Emphasizes treatment of local industrial/hazardous waste problems, including solvent recovery and metals. Lecture, project. Prerequisites: CEE 561, 563.

CEE 567 Environmental Microbiology. (4)

fall

Overview of the microbiology of natural and human-impacted environment, microbial detection methodologies, waterborne disease outbreaks, risk assessment, and regulations. Credit allowed for only CEE 567 or 467. Lecture, lab. Prerequisite: CEE 361 or instructor approval.

CEE 573 Traffic Engineering. (3)

selected semesters

Driver, vehicle, and roadway characteristics, laws and ordinances, traffic control devices, traffic engineering studies, and Transportation System Management measures. Prerequisite: CEE 372.

CEE 574 Highway Capacity. (3)

selected semesters

Highway capacity for all functional classes of highways. Traffic signalization, including traffic studies, warrants, cycle length, timing, phasing, and coordination. Prerequisite: CEE 372.

CEE 580 Practicum. (1–12)

selected semesters

CEE 590 Reading and Conference. (1–12)

selected semesters

CEE 591 Seminar. (1–12)

selected semesters

Topics may include the following:

- Transportation Systems Pro-Seminar

CEE 592 Research. (1–12)

selected semesters

CEE 598 Special Topics. (1–4)

selected semesters

Topics may include the following:

- Environmental Microbiology
Fee.
- Highway Geometric Design
Fee.
- Intelligent Transportation Systems
- Structural Design
Fee.

CEE 599 Thesis. (1–12)

selected semesters

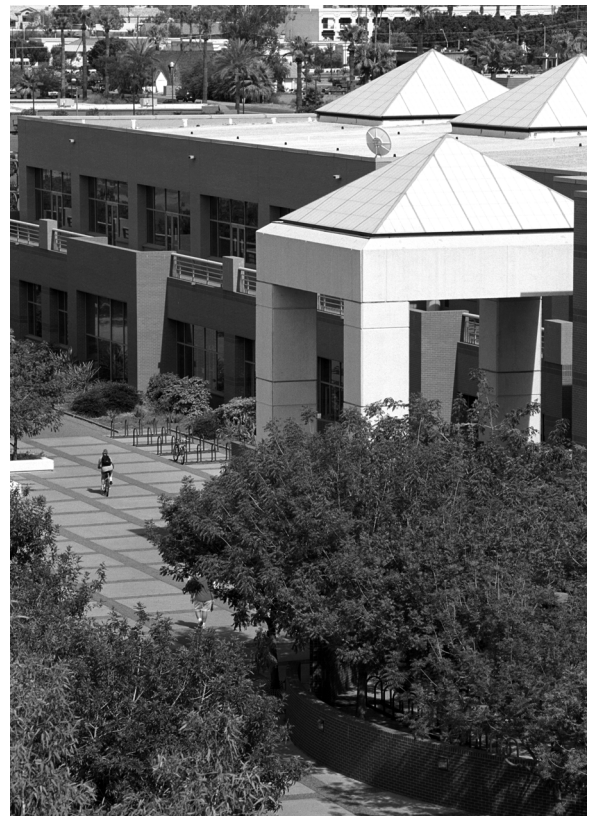
CEE 792 Research. (1–15)

selected semesters

CEE 799 Dissertation. (1–15)

selected semesters

Omnibus Courses. For an explanation of courses offered but not specifically listed in this catalog, see "Omnibus Courses," page 50.



The Student Recreation Complex

Tim Trumble photo

Communication

Master's Program

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480/965-5096

STAUF A412

**Harold Goodall, Director, Hugh Downs School
of Human Communication**

Kory Floyd, Director of the Master's Program

Professors: Alberts, Arnold, Broome, Canary, Carlson, Corman, Guerrero, Jain, Martin, McPhee, Mongeau, Nakayama

Associate Professors: Buley, Corey, Davey, Davis, De la Garza, Floyd, Martinez, Mayer, Trethewey

Assistant Professors: Brouwer, Messman, Park-Fuller, Tracy

Instructional Professional: Olson

Assistant Instructional Professional: McDonald

The Hugh Downs School of Human Communication strives to advance the understanding of message-related human behavior, for the purpose of improving communicative interactions. Teaching, research, and service are directed to the continued development of knowledge and application of the principles of communication. Courses of study are designed to provide students with relevant programs adapted to individual academic and professional goals.

MASTER OF ARTS

Faculty in the Hugh Downs School of Human Communication offer a program leading to the M.A. degree in Communication. Current areas of study within the major are intercultural communication, interpersonal communication, performance studies, organizational communication, and rhetorical studies.

Admission Requirements. Admission is competitive, based upon evidence of the applicant's scholarly and research abilities. All applicants must submit the following:

1. a Graduate College application, completed either online or on paper, along with official undergraduate and graduate transcripts;
2. a statement of professional goals (approximately 500 words);
3. Graduate Record Examination scores (verbal, quantitative, and analytical writing) taken within the past five years, plus other relevant test data provided by the applicant;

4. three letters of recommendation prepared within the preceding 12 months;
5. a writing sample; and
6. all applicants whose native language is not English must submit TOEFL scores; minimum scores are 600 on the paper and pencil version of this test or 250 on the computer version of this test.

A completed application for admission and official transcripts of all undergraduate and graduate work must be submitted to the Graduate Admissions Office. See "Admission to the Graduate College," page 85, for Graduate College general requirements. All application materials must be received by February 1. Late applications cannot be considered.

Program of Study. The program consists of a minimum of 30 semester hours of graduate course work, which includes six semester hours of thesis credit. All students must successfully complete the following:

1. COM 501 Research Methods in Communication with a minimum grade of "B" (3.00);
2. COM 504 Theories and Models in Communication with a minimum grade of "B" (3.00);
3. at least one of the following three courses: COM 508 Quantitative Research Methods in Communication, COM 509 Qualitative Research Methods in Communication, or COM 521 Rhetorical Criticism of Public Discourse with a minimum grade of "B" (3.00);
4. at least three content seminars;
5. a written comprehensive examination on theory and methodology, and an area of study (an oral examination may be required); and
6. a thesis, which is an account of original research, and an oral examination in defense of the thesis.

Applicants with undergraduate deficiencies must remove them, and these courses do not count toward the master's degree. The student's program of study is the mutual responsibility of the student and the supervisory committee. A foreign language is not required but is encouraged. Descriptions of current program options and requirements are available from the school office, STAUF A412.

RESEARCH ACTIVITY

Both applied and theoretical research are an integral part of the master's and doctoral degree programs in Communication. The general areas of study include intercultural communication, interpersonal communication, organizational communication, performance studies, and rhetoric. A variety of metatheoretical approaches are used for studying communication issues, including traditional social science perspectives as well as interpretive and critical approaches. Various methodologies are employed, including quantitative methods such as surveys and questionnaires, ethnographic methods such as interviewing and participant observation, and discourse and textual analyses. Attention is also given to the integration of theory and practice. For more information, visit the school's Web site at com.pp.asu.edu.

**HUGH DOWNS SCHOOL
OF HUMAN COMMUNICATION (COM)**

COM 400 CIP: Communication in Professions. (3)

fall, spring, summer

Specialized study of communication processes in professional and organizational settings. Open to B.I.S. majors only. May be repeated for credit. Lecture, discussion. Prerequisites: both COM 100 and 225 or only COM 259; 2.00 GPA.

COM 404 Research Apprenticeship. (3)

fall and spring

Direct research experience on faculty projects. Student/faculty match based on interests. Lecture, apprenticeship. Prerequisites: COM 308 (or instructor approval); minimum cumulative ASU GPA of 2.50; application required.

COM 407 Advanced Critical Methods in Communication. (3)

fall, spring, summer

Examines critical approaches relevant to communication, including textuality, social theory, cultural studies, and ethnography. Lecture, discussion. Prerequisites: COM 308; minimum cumulative ASU GPA of 2.50.

COM 408 Quantitative Research Methods in Communication. (3)

fall and spring

Advanced designs, measurement techniques, and methods of data analysis of communication research. Prerequisites: COM 308 and a course in generic statistics (EDP 454 or POS 401 or PSY 230 or QBA 221 or SOC 390 or STP 226); minimum cumulative ASU GPA of 2.50.

COM 410 Interpersonal Communication Theory and Research. (3)

fall, spring, summer

Survey and analysis of major research topics, paradigms, and theories dealing with message exchanges between and among social peers. Prerequisites: COM 110 (or 310), 308; minimum cumulative ASU GPA of 2.50.

COM 411 Communication in the Family. (3)

once a year

Broad overview of communication issues found in marriage and family life, focusing on current topics concerning communication in the family. Prerequisites: COM 110 (or 310), 207; minimum cumulative ASU GPA of 2.50.

COM 414 Crisis Communication. (3)

selected semesters

Role of communication in crisis development and intervention. Prerequisite: minimum cumulative ASU GPA of 2.50.

COM 421 Rhetoric of Social Issues. (3)

fall and spring

Critical rhetorical study of significant speakers and speeches on social issues of the past and present. Prerequisites: COM 308, 321 (or 323).

COM 422 Advanced Argumentation. (3)

selected semesters

Advanced study of argumentation theories and research as applied to public forum, adversary, scholarly, and legal settings. Prerequisites: COM 222; minimum cumulative ASU GPA of 2.50.

COM 426 Political Communication. (3)

fall

Theories and criticism of political communication, including campaigns, mass persuasion, propaganda, and speeches. Emphasis on rhetorical approaches. Prerequisite: minimum cumulative ASU GPA of 2.50.

COM 430 Leadership in Group Communication. (3)

selected semesters

Theory and process of leadership in group communication, emphasizing philosophical foundations, contemporary research, and applications to group situations. Prerequisites: COM 230; minimum cumulative ASU GPA of 2.50.

COM 441 Performance Studies. (3)

fall, spring, summer

Theory, practice, and criticism of texts in performance. Emphasis on the interaction between performer, text, audience, and context. Prerequisites: COM 241, 308; minimum cumulative ASU GPA of 2.50.

COM 442 Identity, Performance, and Human Communication. (3)

selected semesters

Explores communication dimensions of self and others as performance. Examines topics including gender, race, sexuality, age, and ethnicity through performance. Lecture, workshops. Prerequisites: COM 225 (or 241); minimum cumulative ASU GPA of 2.50.

COM 445 Narrative Performance. (3)

selected semesters

Theory and practice of performing narrative texts (e.g., prose fiction, oral histories, diaries, essays, letters). Includes scripting, directing, and the rhetorical analysis of storytelling. Prerequisites: COM 241; minimum cumulative ASU GPA of 2.50.

COM 446 Performance of Literature Written by Women. (3)

selected semesters

Explores, through performance and critical writing, literature written by women. Prerequisite: minimum cumulative ASU GPA of 2.50.

COM 450 Theory and Research in Organizational Communication. (3)

fall, spring, summer

Critical review and analysis of the dominant theories of organizational communication and their corollary research strategies. Prerequisites: COM 250, 308; minimum cumulative ASU GPA of 2.50.

COM 453 Communication Training and Development. (3)

once a year

Examines the procedures and types of communication training and development in business, industry, and government. Prerequisites: COM 250; minimum cumulative ASU GPA of 2.50.

COM 463 Intercultural Communication Theory and Research. (3)

fall, spring, summer

Surveys and analyzes major theories and research dealing with communication between people of different cultural backgrounds, primarily in international settings. Lecture, discussion, small group work. Prerequisites: COM 263, 308; minimum cumulative ASU GPA of 2.50.

COM 465 Intercultural Communication Workshop. (3)

selected semesters

Experientially based study of communication between members of different cultures designed to help improve intercultural communication skills. Prerequisites: minimum cumulative ASU GPA of 2.50; instructor approval.

COM 494 Special Topics. (1–3)

fall, spring, summer

Prerequisite: minimum cumulative ASU GPA of 2.50.

COM 501 Research Methods in Communication. (3)

fall

Critical analysis of systems of inquiry in communication, focusing on the identification of variables and approaches to conducting research in communication. Prerequisite: instructor approval.

COM 504 Theories and Models in Communication. (3)

fall

Theory construction, metatheoretical concerns, models, construct definition, and comparative analysis of current theories in communication. Prerequisite: instructor approval.

COM 508 Quantitative Research Methods in Communication. (3)

fall

Empirical research designs, measurements, and statistical strategies and techniques in analyzing and evaluating experimental and descriptive research in communication. Prerequisites: both COM 501 and 504 or only instructor approval.

COM 509 Qualitative Research Methods in Communication. (3)

spring

Qualitative research methods, including interviewing, field methods, and other nonquantitative techniques for analyzing communication. Prerequisites: both COM 501 and 504 or only instructor approval.

COM 521 Rhetorical Criticism of Public Discourse. (3)

selected semesters

History and significance of rhetorical theory and criticism in the analysis of public discourse. Prerequisites: both COM 501 and 504 or only instructor approval.

COM 584 Communication Internship. (1–12)

fall, spring, summer

Fee.

GRADUATE PROGRAMS AND COURSES

COM 604 Theory Construction in Communication. (3)

fall

Review and analysis of philosophical problems inherent in communicative research and of metatheories designed to deal with these problems. Prerequisite: COM 504 or instructor approval.

COM 607 Contemporary Rhetorical Methods. (3)

spring

Analysis of issues in the practice of rhetorical communication research, including criticism and scholarship. Seminar.

COM 608 Multivariate Statistical Analysis of Data in Communication. (3)

spring

Statistical analysis of communication research data. Multivariate procedures used in communication research and methods of causal analysis. Prerequisites: COM 501 and 508 (or their equivalents).

COM 609 Advanced Qualitative Research Methods in Communication. (3)

fall

Analysis of issues in the practice of qualitative communication research, including data gathering, fieldwork issues, analysis strategies, and reporting results. Prerequisite: COM 509 or instructor approval.

COM 691 Seminar. (1–12)

fall, spring, summer

Lecture, discussion. Topics may include the following:

- Current Organizational Approaches to Communication. (3)
- Intercultural Aspects of Communication. (3)
- Interpersonal and Relational Communication. (3)
- Research in Performance Studies. (3)
- Rhetorical Issues. (3)
- Social Influence. (3)

Prerequisite: instructor approval.

COM 792 Research. (1–12)

selected semesters

Topics may include the following:

- Prospectus/Dissertation Practicum. (3)
- Seminar Assistant. (3)

COM 799 Dissertation. (1–15)

selected semesters

Omnibus Courses. For an explanation of courses offered but not specifically listed in this catalog, see "Omnibus Courses," page 50.

Communication

Interdisciplinary Doctoral Program

com.pp.asu.edu/academic/doctorate.html

480/965-5096

STAUF A412

**Jess K. Alberts, Director, Hugh Downs School
of Human Communication**

Paul A. Mongeau, Director, Doctoral Program

Educational Leadership and Policy Studies

Associate Professor: Margolis

English

Professors: Roen, Miller

Associate Professor: Goggin

Family and Human Development

Professors: Christopher, Fabes

Human Communication

Professors: Alberts, Arnold, Broome, Canary, Carlson, Corman, Guerrero, Jain, Martin, McPhee, Mongeau, Nakayama

Associate Professors: Buley, Corey, Davey, Davis, De la Garza, Floyd, Martinez, Mayer, Trethewey

Assistant Professors: Brouwer, Messman, Park-Fuller, Tracy

Journalism and Mass Communication

Professor: Godfrey

Justice Studies

Regents' Professor: Altheide

Professors: Johnson, Romero

Recreation Management and Tourism

Professor: Allison

Assistant Professor: Leclerc

DOCTOR OF PHILOSOPHY

The Committee of Faculty offers an interdisciplinary graduate program leading to the Ph.D. degree in Communication. Concentrations are available in communicative development, intercultural communication, and organizational communication.

The program is housed in the Hugh Downs School of Human Communication and is designed to prepare scholars



The Brickyard, in downtown Tempe, houses the Ira A. Fulton School of Engineering dean's office and the Department of Computer Science and Engineering.

Tim Trumble photo

for research-oriented careers in universities and in the public or private sectors. Students are provided training in communication theory, research methodology, and a specialization in one or more areas of concentration. The goal of the program is to meet the needs of students whose interests transcend traditional disciplinary boundaries.

See “Doctor of Philosophy,” page 96, for general requirements.

Admission Requirements. Admission to the program is competitive. Applications are considered once a year for fall admission with a supplemental admission deadline late in the spring term. Applicants must have earned either a bachelor’s or master’s degree and must present evidence of scholarly writing (e.g., an undergraduate honors thesis, a master’s thesis, or their equivalent). All applicants should be knowledgeable in the basic principles of both qualitative and quantitative methods of research, social statistics, and communication theory. If course work in these areas has not been completed, admitted students are required to successfully complete COM 501 Research Methods in Communication and COM 504 Theories and Models in Communication (plus any other courses stipulated by the admissions committee) before enrolling in the required theory and methodology sequence. Knowledge in statistics must be demonstrated either by completion of a graduate-level statistics course within two years before admission to the program, by completion of COM 508 within the first two years of course work, or by some other option approved by the director of the doctoral program. In addition to meeting the minimum Graduate College admission requirements, the applicant’s scholastic and professional record must indicate special interest in and aptitude for systematic research in communication. All applicants must submit the following:

1. a completed Graduate College application and official undergraduate and graduate transcripts;
2. a formal *curriculum vitae*, including a statement of career goals and the relevance of this degree program to those goals;
3. Graduate Record Examination (GRE) scores (verbal, quantitative, and analytical writing) taken within the past five years, plus other relevant test data volunteered by the applicant;
4. three letters of recommendation written within the preceding 12 months, including at least one letter from a previous faculty member;
5. a sample of writing (e.g., master’s thesis, course paper); and
6. a minimum score of 600 on the Test of English as a Foreign Language for all applicants whose native language is not English.

All application materials must be in the program office by January 15 to be considered. Late applications are processed once late in the spring term.

Supervisory/Dissertation Committee. This committee consists of a chair and at least two other members appointed by the dean of graduate studies based upon the director’s recommendation. At least two-thirds of the committee must be full-time faculty at the ASU Main Campus and at least

two-thirds of the committee must be from the communication faculty. At least one member must be from an academic discipline outside of communication. The chair of the supervisory committee, who serves as the student’s advisor, must be knowledgeable in the student’s area of concentration, have an active research agenda, publish regularly in appropriate refereed academic journals, and be experienced in graduate education. Members of the 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 comprehensive examinations, and the dissertation research.

Areas of Concentration. Students admitted to the program select a formal area of concentration in any of the three broad areas of communicative development, intercultural communication, and organizational communication. However, the interdisciplinary nature of the program and breadth of its faculty allow students to design individual programs of study geared toward more specialized topics in human communication. As a rule, these cut across the formal areas of concentration and generally follow the areas of expertise of program faculty. Program graduates study areas such as interpersonal communication, organizational communication, performance studies, rhetoric, critical/cultural studies, relational communication, and information technology. Because of the interdisciplinary nature of the Ph.D. program, students may explore relevant course work in disciplines such as communication, social and development psychology, family studies, educational psychology, cultural anthropology, comparative sociology, linguistics, justice studies, industrial psychology, management, and public administration, among others. Contact the director for an up-to-date list of program faculty and their areas of interest.

Communicative Development. The communicative development emphasis includes three distinct specialty areas: interpersonal communication, performance studies, and rhetoric/public communication. *Interpersonal communication* refers to the exchange of messages between people in a variety of contexts, most of which concern relational aspects of communication. *Performance studies* focuses on activism and advocacy through performance with special emphasis on contemporary issues related to diversity, justice, sexuality, health, and other social and cultural concerns. *Rhetoric/public communication* considers how discourses function persuasively as social, cultural and political phenomena, and a variety of discourses are engaged, including social movements, political campaigns, legal argument, and popular culture.

Intercultural Communication. Intercultural communication focuses on the theoretical and conceptual relationships between culture and communication.

Organizational Communication. Organizational communication focuses on the conditions, impacts, and implications of communicative processes and systems for both public and private sector organizations.

Program of Study. If the student has completed an appropriate master’s degree, the Ph.D. requires a minimum of 66 hours beyond the master’s degree. Course work for a typical

GRADUATE PROGRAMS AND COURSES

program of study is distributed as follows: required core courses (9 semester hours), area of concentration (33 semester hours), dissertation (COM 799) and research (COM 792) (24 semester hours) for a total of 66 hours (minimum). Up to 12 semester hours of research (COM 792) may be taken before admission to candidacy. Three interdisciplinary theory and methodology courses are required of all students entering the program. The required theory course is COM 604 Theory Construction in Communication. Students are required to take three semester hours of COM 792 R: Prospectus/Dissertation Practicum and three semester hours of COM 792 R: Seminar Assistant. In addition, students must take two of the three methods courses, which consist of COM 607 Contemporary Rhetorical Methods, COM 608 Multivariate Statistical Analysis of Data in Communication, and COM 609 Advanced Qualitative Research Methods in Communication.

The student is also required to demonstrate proficiency in research methods (statistics, computer languages, content analysis methods, participant observation, etc.) which, in the judgment of the supervisory committee, is needed for the student's dissertation research. Evidence of required proficiency may be demonstrated by established university examination procedures or by successful completion of a sequence of courses designated by the student's program committee.

For students who have completed only the bachelor's degree before admission to the Ph.D. program, a minimum of 90 hours of interdisciplinary graduate work is required for the program, including the same 66-hour requirement for students with the master's degree. The initial course work for students admitted with only a bachelor's degree is similar to the M.A. degree requirements in Communication except that no thesis is required. These requirements include a general overview of research in communication (COM 501), an overview of theories and models of communication (COM 504), a statistics course (COM 508), and electives from communication or other disciplines to total 24 hours of course work. The methods, theory, and statistics courses must be completed before beginning the required theory and methodology sequence for the Ph.D. (i.e., they are prerequisites for the required courses).

Foreign Language Requirements. None.

Comprehensive Examination. Upon completion of course work and before the formal approval of the dissertation proposal, the student is examined in the relevant area of concentration and research methods. The examination consists of written and oral components designed to test the student's interdisciplinary knowledge in the field and chosen area of concentration and the student's readiness to under-

take interdisciplinary dissertation research. The examination is conducted by the student's supervisory committee.

Admission to Candidacy. After the student has passed both the written and oral portions of the comprehensive examination and the student's dissertation topic has been approved, the student may apply to the Graduate College for admission to candidacy. Before admission to candidacy, it is expected that students have completed a mixture of academic experiences, including formal course work, participation in doctoral seminars, research with faculty, and independent research that are related to the topic of the dissertation and lead up to the dissertation. It is also expected that students have been exposed to both quantitative and qualitative methods of research before candidacy. No dissertation hours (COM 799) may be taken before admission to candidacy, but research hours (COM 792) may be taken before admission to candidacy. Students must enroll for 12 hours of dissertation (COM 799) credit following the semester in which they are advanced to candidacy.

Dissertation Proposal. Before conducting the research for the dissertation, each student must submit a dissertation proposal that is defended orally and approved by the student's dissertation committee.

Research and Dissertation. The dissertation consists of a fully documented written analysis of a problem that extends the knowledge and/or theoretical framework of the field and reflects the student's creativity and competence in independent, interdisciplinary research using an appropriate research methodology.

Final Examination. An oral examination in defense of the dissertation, conducted by the dissertation committee, is required.

RESEARCH ACTIVITY

Both applied and theoretical research are an integral part of the master's and doctoral degree programs in Communication. The general areas of study include intercultural communication, interpersonal communication, organizational communication, performance studies, and rhetoric. A variety of metatheoretical approaches are used for studying communication issues, including traditional social science perspectives as well as interpretive and critical approaches. Various methodologies are employed, including quantitative methods such as surveys and questionnaires, ethnographic methods such as interviewing and participant observation, and discourse and textual analyses. Attention is also given to the integration of theory and practice. For more information, visit the school's Web site at com.pp.asu.edu.

Communication Disorders

Master's Program

www.asu.edu/clas/shs

480/965-2374

COOR 2211

David Ingram, Chair

Professors: S. Bacon, Dorman, D. Ingram, Sinex, Wilcox

Associate Professor: Liss

Assistant Professors: Azuma, Edgar, Gray

Clinical Professors: Mathy, Wiley

Clinical Associate Professors: C. Bacon, Brown, Mintz

Clinical Assistant Professors: K. Ingram, McBride, Wexler

MASTER OF SCIENCE

The faculty in the Department of Speech and Hearing Science offer a program leading to the M.S. degree in Communication Disorders. Thesis and nonthesis degree options are available. The speech-language pathology program is accredited by the Council on Academic Accreditation of the American Speech-Language-Hearing Association. The Department of Speech and Hearing Science also offers the Doctor of Audiology and participates in the interdisciplinary Ph.D. in Speech and Hearing Science degree programs.

Admission Requirements. Students applying for admission to this program should have their undergraduate transcripts, Graduate Record Examination scores, a statement of professional and academic goals not to exceed 200 words, and three letters of recommendation mailed to the Graduate Admissions Office. All materials must be received by January 15 for fall admission, which is the only term in which students may begin their program of study. Candidates who have undergraduate deficiencies may need to take required prerequisite courses.

Academic Requirements. A student must complete 37 semester hours of graduate course work, exclusive of credit for practicum, as approved by the supervisory committee.

Statistical Proficiency Requirements. A student pursuing the M.S. degree must provide satisfactory evidence of competency in statistical methods appropriate to the behavioral sciences.

Clinical Requirements. A student in the M.S. program must complete at least 400 clock hours of supervised clinical practicum experience, of which a minimum of 325 clock hours must be obtained at the graduate level.

Thesis Option. Students wishing to pursue the thesis option must complete 37 semester hours of course work, six hours

of which must be thesis credit, excluding practicum and internship hours. The thesis must meet requirements established by the Graduate College.

Nonthesis Option. Students choosing the nonthesis option must complete 37 semester hours of course work, excluding practicum and internship hours.

Final Examinations. For a candidate for the M.S. degree (thesis option), two final examinations are required: (1) the ASHA Praxis national certification examination in speech-language pathology, and (2) an oral defense of the thesis. For a candidate for the M.S. degree (nonthesis option), two final examinations are required: (1) the ASHA Praxis national certification examination in speech-language pathology, and (2) a four-hour comprehensive written examination administered in October and March of each year by the departmental graduate faculty.

Students should expect to spend two years completing the academic, practicum, and research requirements for either degree option.

RESEARCH ACTIVITY

The Department of Speech and Hearing Science conducts active research programs, many federally funded, in a broad range of areas of speech, language, and hearing. Specific topics include early intervention studies, normal and disordered language acquisition, adult language disorders, cochlear implants, auditory processing of speech, psychoacoustics, and speech perception. Research interests of individual faculty members may be found on the department's Web site at www.asu.edu/clas/shs.

SPEECH AND HEARING SCIENCE (SHS)

SHS 401 Introduction to Audiology. (3)

fall

Introduces hearing disorders and the purposes and procedures for basic clinical tests of auditory function. Credit is allowed for only SHS 401 or 501. Prerequisites: both SHS 311 and 376 or only instructor approval.

SHS 402 Modifying Communicative Behavior. (3)

fall

Principles and techniques of modifying speech and language behavior. Prerequisite: SHS 250 (or its equivalent).

SHS 465 Speech and Language Acquisition. (3)

spring

Speech and language development in the normal child. Prerequisite: SHS 367 (or its equivalent).

SHS 485 Acquired Speech and Language Disorders. (3)

spring

Introduces acquired speech and language disorders across the lifespan. Prerequisites: SHS 250, 310.

SHS 496 Aural Rehabilitation. (3)

spring

Approaches to aural rehabilitation of children and adults. Introduces educational audiology and assistive listening devices. Prerequisites: SHS 375 and 376 and 401 (or their equivalents).

SHS 500 Research Methods in Communication Disorders. (3)

spring

Surveys research methods in areas related to speech, language, and hearing.

SHS 501 Introduction to Audiologic Evaluation. (3)

fall

Measurement of the basic audiologic test battery, including audiograms, immittance, masking, and speech recognition. Credit is allowed for only SHS 501 or 401. Prerequisites: SHS 311, 376 (or their equivalents).

GRADUATE PROGRAMS AND COURSES

SHS 502 Basic Audiometry. (4)

fall or spring

Covers the bases, purposes, rationales, and procedures for the core clinical tests of auditory function in adults and children. Lecture, lab, discussion, case studies, student presentations. Pre- or corequisite: SHS 513 or instructor approval.

SHS 504 Amplification I. (4)

fall or spring

Operation, electroacoustic measurement, selection, and prescriptive fitting of amplification devices. Lecture, lab, discussion, case studies, guest lecturers, seminar, student presentations. Prerequisites: a combination of SHS 502 and 513 and 515 or only instructor approval.

SHS 505 Survival Sign Language. (2)

fall or spring

Facilitates effective manual and alternative methods of communication with deaf individuals in clinical settings. Discussion, case studies, demonstrations, interactive, student presentations.

SHS 508 Pediatric Audiology. (3)

fall or spring

Emphasizes the principles and procedures for early identification and management of congenital and early-onset hearing loss. Lecture, discussion, case studies, seminar, student presentations. Prerequisite: SHS 502 or instructor approval.

SHS 510 Amplification II. (4)

fall or spring

Verification and validation of hearing aid performance, benefit, and satisfaction. Fitting considerations for pediatric and geriatric populations. Lecture, lab, discussion, case studies, guest lecturers, seminar, student presentations. Prerequisites: a combination of SHS 502 and 504 and 513 and 515 or only instructor approval.

SHS 511 Psychoacoustics of Hearing Impairment. (3)

fall or spring

Psychophysical methods and behavioral aspects of hearing, with an emphasis on the perceptual consequences of sensorineural hearing loss. Lecture, discussion, demonstrations, seminar, student presentations. Prerequisites: both SHS 376 and 513 or only instructor approval.

SHS 512 Medical Aspects of Speech and Hearing. (3)

spring

Correlation of history and physical findings with pathologic physiology and test results in speech and hearing abnormalities.

SHS 513 Neurophysiology of the Auditory System. (3)

fall or spring

Focuses on the neurophysiology of the normal auditory system and on changes associated with hearing loss. Lecture, discussion, demonstrations. Prerequisite: instructor approval.

SHS 515 Instrumentation and Calibration. (3)

fall

Electronic instruments used to produce, modify, and measure characteristics of sound. Measurement standards and methods for calibration of audiologic equipment. Lecture, lab. Prerequisite: SHS 401 or instructor approval.

SHS 516 Auditory-Evoked Potentials. (3)

fall or spring

Electrophysiologic assessment of the peripheral and central auditory nervous system. Lecture, lab. Prerequisites: both SHS 502 and 513 or only instructor approval.

SHS 517 Balance Assessment. (3)

fall or spring

Clinical analysis and treatment of balance disorders and dizziness. Lecture, discussion, case studies, seminar, student presentations. Pre- or corequisite: SHS 513 or instructor approval.

SHS 518 Auditory Rehabilitation. (2)

fall or spring

Study and clinical application of assistive technology and rehabilitative services for managing the effects of hearing impairment. Lecture, lab, discussion, case studies, seminar, student presentations. Pre- or corequisites: both SHS 502 and 504 or only instructor approval.

SHS 519 Auditory Pathologies and Disorders. (3)

fall or spring

Familiarizes students with major diseases, pathologies, and disorders of the human auditory system. Lecture, discussion, case studies, demonstrations, field trips, seminar, student presentations. Prerequisites: both SHS 502 and 513 or only instructor approval.

SHS 520 Otoneurologic Applications in Audiology. (3)

fall or spring

Advanced otologic, neurologic, and audiologic approaches in the differential diagnosis of peripheral and central disorders of the auditory system. Lecture, lab, discussion, case studies, seminar, student presentations. Prerequisites: a combination of SHS 502 and 513 and 516 and 552 or only instructor approval.

SHS 521 Auditory Aging. (2)

fall or spring

Focuses on aging and related effects on the auditory system and audition. Lecture, discussion, case studies, seminar, student presentations. Prerequisites: both SHS 502 and 513 or only instructor approval.

SHS 522 Hearing Conservation. (2)

fall or spring

Examines the prevention, identification, physiological effects, and management of hearing loss due to noise exposure. Lecture, discussion, seminar, student presentations. Prerequisites: both SHS 502 and 513 or only instructor approval.

SHS 524 Counseling for the Hearing Impaired. (2)

fall or spring

Theories of counseling emphasizing the psychosocial and emotional impact and the management of individuals with hearing and their families. Lecture, discussion, case studies, seminar, student presentations. Prerequisites: both SHS 502 and 504 or only instructor approval.

SHS 525 Audiology Practice Management. (3)

fall or spring

Business practice issues, quality assurance, and professional ethics for the practicing audiologist. Lecture, discussion, case studies, seminar, student presentations. Prerequisites: both SHS 502 and 504 or only instructor approval.

SHS 545 Speech Perception by the Hearing Impaired. (2)

fall or spring

Focuses on the perception of speech by normal-hearing and hearing-impaired listeners. Lecture, discussion, case studies, seminar, student presentations. Prerequisite: instructor approval.

SHS 552 Physiological Measures of Auditory Function. (3)

fall or spring

Focuses on the measurement of otoacoustic emissions and acoustic immittance. Lecture, discussion, student presentations. Prerequisite: SHS 513 or instructor approval.

SHS 555 Cochlear Implants. (3)

spring

Current status of cochlear implant research and development. Prerequisites: both SHS 504 and 545 or only instructor approval.

SHS 565 Speech and Language Acquisition. (3)

spring

Speech and language development in the normal child. Prerequisite: SHS 367 (or its equivalent).

SHS 566 Psychology of Language. (3)

spring

Psycholinguistic study of the production and comprehension of language across the lifespan.

SHS 567 Neural Bases of Communication Disorders. (3)

fall

Neuroscience and its application to matters of normal and disordered communication. Pre- or corequisite: SHS 310 (or its equivalent).

SHS 570 Communication Disorders and Multicultural Populations. (3)

fall

Studies racial and ethnic biases and the communication behaviors and disorders in various cultural groups.

SHS 571 Augmentative Communication and Language Programming. (3)

fall

Focuses on individuals across the age span who are unable or who are at risk for being unable to communicate with spoken language. Lecture, lab.

SHS 572 Language Assessment and Intervention in Early Childhood. (3)

fall

Focuses on the birth to 5-year-old population who are at risk for or who have communication and language disabilities. Prerequisite: SHS 470 (or its equivalent).

SHS 573 Language Assessment and Intervention with School-Age Populations. (3)

fall

Focuses on later language development, linguistic demands of academic settings, assessment and intervention strategies for older children and adolescents. Prerequisite: SHS 565 (or its equivalent).

SHS 574 Fluency Disorders and Treatment. (3)

fall

Presents phenomena, etiology, assessment, and theories of stuttering, followed by various treatment procedures for children and adults who stutter. Prerequisite: SHS 431 (or its equivalent).

SHS 575 Aphasia and Related Neurogenic Language Disorders. (3)

spring

Assessment and treatment of acquired neurolinguistic impairment. Prerequisite: SHS 567.

SHS 576 Neuromotor Speech Disorders. (3)

spring

Evaluation and treatment of the dysarthrias and apraxia of speech. Emphasizes acquired adult disorders.

SHS 577 Craniofacial Disorders of Communication. (3)

spring

Communication disorders related to anomalies of the craniofacial structures, including orofacial clefting of the lip and palate. Prerequisite: SHS 310 (or its equivalent).

SHS 578 Disorders of Voice. (3)

spring

Communication disorders related to dysfunction of the phonatory and resonance systems of voice production, assessment, and treatment. Prerequisite: SHS 310 or instructor approval.

SHS 579 Feeding and Swallowing Disorders Across the Lifespan. (3)

fall

Focuses on individuals across the age span who have feeding and/or swallowing disorders. Presents assessment and treatment strategies. Prerequisite: SHS 567.

SHS 580 Clinical Practicum. (1–6)

fall, spring, summer

Supervised practicum speech-language pathology. 1 hour staffing and 3 hours of client contact per week per hour of credit. May be repeated for credit. Prerequisites: instructor approval; student must not have provisional admission status.

SHS 581 Right Hemisphere Syndrome, Traumatic Brain Injury, and Dementia. (3)

spring

Studies the nature, characteristics, and clinical management of cognitive and communicative impairments accompanying right hemisphere damage, TBI, and dementia. Prerequisite: SHS 567.

SHS 582 Differential Diagnosis of Communication Disorders. (3)

spring

Procedures for assessing speech/language disorders in children and adults. 3 hours lecture, 2 hours lab. Prerequisites: SHS 250 and 310 and 465 and 567 (or their equivalents).

SHS 584 Internship. (1–6)

fall, spring, summer

Off-campus directed experiences in speech-language pathology. May be repeated for credit. Prerequisites: SHS 580; student must consult with coordinator before registration.

SHS 585 Articulation and Phonology: Assessment and Intervention. (3)

fall

Assessment and treatment of developmental articulation and phonological disorders. Prerequisites: SHS 250 and 310 (or their equivalents).

SHS 589 Audiology Grand Rounds. (1)

fall or spring

Grand Rounds bridges clinical and academic knowledge through case studies, application of emerging research, and clinical workshops. Discussion, case studies, interactive, seminar, student presentations. Prerequisite: SHS 502 or instructor approval.

SHS 591 Seminar. (1–12)

fall, spring, summer

Topics may include the following:

- Bilingual Language Assessment and Intervention. (3)
spring
- Clinical Methods for Craniofacial Disorders. (1)
spring
- Clinical Methods for Fluency Disorders. (1)
fall
- Clinical Methods for Language Assessment. (1)
spring
- Clinical Methods for Motor Speech Disorders. (1)
spring
- Clinical Methods for Voice Disorders. (1)
fall
- Cognitive and Linguistic Interactions in Adult Neurogenic Disorders. (3)
fall
- Clinical Methods for Language Assessment. (1)
spring
- Preschool Language Disorders. (3)
spring
- Spanish Language Acquisition. (3)
fall

SHS 596 Aural Rehabilitation. (3)

spring

Approaches to aural rehabilitation in children and adults. Introduces educational audiology and assistive listening devices. Prerequisite: SHS 401 or 501 (or its equivalent).

SHS 597 Audiology Clerkship. (1–6)

fall or spring

Provides students with advanced, intensive clinical experiences within selected audiological facilities. May be repeated for credit. Practicum. Prerequisites: SHS 580; faculty coordinator approval.

SHS 792 Research. (1–12)

selected semesters

SHS 799 Dissertation. (1–15)

selected semesters

Omnibus Courses. For an explanation of courses offered but not specifically listed in this catalog, see "Omnibus Courses," page 50.

Communication and Human Relations

Certificate Program

ASU West offers a postbaccalaureate certificate in Communication and Human Relations. For information, see the *ASU West Catalog*, call 602/543-4567, or access www.west.asu.edu on the Web.

Communication Studies

Master's Program

ASU West offers a Master of Arts degree in Communication Studies. For information, see the *ASU West Catalog*, call 602/543-4567, or access www.west.asu.edu on the Web.

Composition

See "Music," page 280.

Computational Biosciences

Interdisciplinary Master's Program

www.asu.edu/compbiosci

480/965-5519

PS A216

Rosemary Renaut, Director

Participating faculty from the colleges, departments, and schools of Chemistry and Biochemistry, Computer Science and Engineering, Health Administration and Policy, Life Sciences, and Mathematics and Statistics offer a program leading to the Professional Science Master's (P.S.M.) degree in Computational Biosciences.

The disciplines of the life sciences are rapidly requiring more mathematical and computational analyses than have typically been employed. While some mathematical approaches have been applied to biological questions for many years, the advance in computational capability has increased the pace of bioscience research to unprecedented levels of speed, precision, and detail, and thus dramatically transformed the kinds of problems tackled. The P.S.M. degree serves to produce students capable of meeting the demands of today's bioinformatics/biomedical industries.

Admissions. In addition to the minimum requirements for admission established by the Graduate College, the interdisciplinary nature of this program makes individual aptitudes and experiences important with regard to a student's competitive status. Applications are accepted for fall only.

Fees. In addition to tuition, program fees apply. For more information, call 480/965-5519.

Prerequisites. Requirements include one-year sequences in chemistry and biology, one semester of calculus and differential equations, a course in data structures and analysis of algorithms, a course with a substantial programming component, a course in organic chemistry, and a course in statistics. Students deficient in a limited number of courses that can be taken over one summer may be admitted provisionally upon completion of the prerequisites in the preceding summer sessions.

Program of Study. The master's program requires a total of 30 semester hours of course work and an additional six hours for internship or further advanced study and six semester hours of graduate-level study on professional issues in biotechnology for a total of 42 semester hours of study. The core program (taken by everyone) is followed by electives designed around the specific interest of the student.

Core Program

CBS 520 Modeling and Computational Biology.....	4
CBS 521 Applications and Complex Problem Solving in Computational Biology	4
CBS 530 Introduction to Structural and Molecular Biology.....	4
CBS 584 Internship	6
CBS 598 ST: Experimental Design	3
CBS 598 ST: Multivariate Statistical Analysis.....	3

Professional Option

CBS 598 ST: Business Issues and Ethics I.....	3
CBS 598 ST: Business Issues and Ethics II	3

Comprehensive Examinations. None.

Thesis Requirements. None.

Internships and Applied Projects. An internship with either a campus-based research group or a bioinformatics/biomedical facility approved by ASU, culminating in a written report and an oral presentation and examination, is required of all students.

Elective Fields. Computational molecular biology, bioinformatics, mathematics, computer science engineering, biochemistry and chemistry, biology, plant biology, and microbiology.

COMPUTATIONAL BIOSCIENCES (CBS)

CBS 520 Modeling and Computational Biology. (4)

fall

Key mathematical and computational techniques for bioinformatics. Numerical and visualization software; scripting, database management. Lecture, computing lab. Fee. Prerequisites: both MAT 271 and 274 (or 275) or only instructor approval.

CBS 521 Applications and Complex Problem Solving in Computational Biology. (4)

spring

Continuation of CBS 520. Key mathematical concepts. Team solution of bioinformatics applications, project writing, and presentation. Lecture, computing lab. Fee. Prerequisite: CBS 520 or instructor approval.

CBS 530 Introduction to Structural and Molecular Biology. (4)

fall

Structure and function of cells, proteins, membranes, and the genome; gene expression and biogenesis of structures; application of computer imaging. Cross-listed as PLB 530. Credit is allowed for only CBS 530 or PLB 530. Prerequisites: one year of biology; one semester of organic chemistry.

CBS 572 Data Mining. (3)*spring*

Advanced data mining techniques: classification, clustering, association, preprocessing; performance evaluation; information assurance, Web mining, security and privacy issues, and other applications.

Cross-listed as CSE 572. Credit is allowed for only CBS 572 or CSE 572. Prerequisite: CSE 412 or 471 or ECE 380 (or their equivalents).

CBS 584 Internship. (6)*selected semesters*

Internship with a local biotechnical/biomedical group culminating in a written and/or oral representation.

CBS 598 Special Topics. (1–4)*selected semesters*

Topics may include the following:

- Business Issues and Ethics I. (3)
- Business Issues and Ethics II. (3)
- Experimental Design. (3)
- Multivariate Statistical Analysis. (3)

Omnibus Courses. For an explanation of courses offered but not specifically listed in this catalog, see "Omnibus Courses," page 50.

Computer Science

Master's and Doctoral Programs

cse.asu.edu

480/965-3190

BYENG

Sethuraman Panchanathan, Chair

Professors: Baral, Colbourn, Collofello, Farin, Golshani, Kambhampati, Lee, Lewis, Nielson, Panchanathan, Tsai, J. Urban, S. Urban, Yau

Associate Professors: Bazzi, Bhattacharya, Candan, Dasgupta, Dietrich, Faltz, Gupta, Huey, Liu, Miller, O'Grady, Sen, Xue

Assistant Professors: Cam, Chatha, Davulcu, Gannod, Richa, Ryu, Sarjoughian, Syrotiuk

The faculty in the Department of Computer Science and Engineering offer graduate programs leading to M.S. and Ph.D. degrees in Computer Science. The faculty also offer a professional graduate program leading to the Master of Computer Science degree. The department offers a concentration in the area of arts, media, and engineering, and graduate students can exercise this option while pursuing their graduate studies.

Areas of study include algorithms, artificial intelligence, bioinformatics, computer-aided geometric design and computer graphics, computer networks, database systems, distributed computing and operating systems, embedded systems, information assurance, intelligent information integration, multimedia information systems, and software engineering.

MASTER OF SCIENCE

The M.S. degree program in Computer Science stresses formal course work to provide breadth of material, and it culminates with a thesis that demonstrates depth in a particular research area.

Admission. See "Admission to the Graduate College," page 85, for general requirements. An applicant for the M.S. program should normally have a baccalaureate degree in computer science, computer engineering, or a closely related area. The applicant's undergraduate GPA and depth of preparation in computer science and engineering are the primary factors affecting admission. Every applicant must submit scores for the Graduate Record Examination (GRE) (verbal, quantitative, and analytical required; the subject test in computer science is optional). An international student must also submit Test of English as a Foreign Language (TOEFL) scores. The application deadline for admission in the fall semester is January 15, and the deadline for admission in the spring semester is September 1. The deadlines for financial aid are January 15 and August 15, respectively.

Program of Study. Each student defines a potentially unique program of study in conjunction with an advisor, subject to approval of the department and the Graduate College. The program of study must include courses in four focus areas, at least nine credit hours in a research area, and a minimum of 30 semester hours of approved graduate-level course work (including a thesis). At least 21 semester hours must be formal course work, and at least 18 hours must be CSE 500-level credits (excluding CSE 598). The department may prescribe additional courses based on the background of the candidate. No foreign language is required.

Final Examination. The student must pass a final oral examination in defense of the thesis and over the course work taken for the degree and the appropriate undergraduate prerequisites.

MASTER OF COMPUTER SCIENCE

The faculty in the Department of Computer Science and Engineering offer a professional program leading to the Master of Computer Science (M.C.S.) degree. The M.C.S. program provides a professionally oriented, graduate-level education in computer science and engineering. The program reflects the dual nature of computer science as both a scientific and engineering discipline by allowing emphasis on theory as well as practical applications. Students can study topics such as artificial intelligence, computer-aided geometric design, computer architecture, computer graphics, computer science theory, database concepts, digital systems design, distributed systems, language processing, networking, operating systems, and software engineering.

Admission. An applicant for the M.C.S. program should normally have a baccalaureate degree in computer science, computer engineering, or a closely related area. The applicant's undergraduate GPA, GRE (verbal, quantitative, and analytical) score, and depth of preparation in computer science and engineering are the primary factors affecting admission. The GRE subject test in computer science is

GRADUATE PROGRAMS AND COURSES

optional. An international student must also submit the results of the TOEFL. The application deadline for admission in the fall semester is January 15, and September 1 for the spring semester. The deadlines for financial aid are January 15 and August 15, respectively. See "Admission to the Graduate College," page 85.

Program of Study. Each student defines a potentially unique program of study subject to approval by the department and the Graduate College. The program of study must include courses in four focus areas and must contain a minimum of 30 semester hours of approved graduate-level course work. At least 18 hours must be CSE 500-level credits (excluding CSE 598), and at least 27 hours must be for formal course work. A three-semester hour course, CSE 593 Applied Project, is also required. The department may prescribe additional courses based on the background of the candidate.

Foreign Language Requirements. None.

Thesis Requirements. None.

Final Examination. M.C.S. students must complete a graded final project (CSE 593) and submit a report on the project.

DOCTOR OF PHILOSOPHY

The Ph.D. degree in Computer Science is available for students of high ability who show promise for original research.

Admission. An applicant for the Ph.D. program should have the equivalent of a baccalaureate major in computer science, computer engineering, or a closely related area. Most applicants should have earned the master's degree, but applicants with exceptional attainments in their baccalaureate are admitted directly into the Ph.D. program. The primary factors affecting admission include the applicant's GPA, depth of preparation in computer science and engineering, GRE (verbal, quantitative, analytical, and computer science) scores, a statement of purpose and three letters of recommendation. An international student must submit TOEFL scores. The application deadline for admission in the fall semester is January 15, and the deadline for admission in the spring semester is September 1. The deadlines for financial aid are January 15 and August 15, respectively. See "Doctor of Philosophy," page 96, for general requirements.

Residency. In addition to the Graduate College's requirement for one year of full-time residency, the Department of Computer Science and Engineering stipulates one additional year of full-time residency for dissertation research.

Program of Study. Each student must file a program of study for approval by the supervisory committee, the department, and the Graduate College.

Foreign Language Requirements. None. The program committee, however, may establish a requirement depending upon the research interests of the candidate.

Comprehensive Examinations. A student must pass a comprehensive examination, which has a mandatory written component, before being admitted to candidacy. The examination has both oral and written components, testing the student's general knowledge in the dissertation area as well as closely related areas. International students must achieve a passing score on the TSE or SPEAK exam before the comprehensive examination.

Dissertation Requirements. A student must complete a dissertation based on original work to demonstrate creativity in research and scholarly proficiency in the subject area.

Final Examination. The student must pass a final oral examination in defense of the dissertation.

RESEARCH ACTIVITY

Research areas include algorithms, artificial intelligence, bioinformatics, computer-aided geometric design and computer graphics, computer networks, database systems, distributed computing and operating systems, embedded systems, information assurance, intelligent information integration, multimedia information systems, and software engineering. In addition, the department conducts research closely with the Center for Cognitive Ubiquitous Computing; Center for Research in Arts, Media, and Engineering; and Partnership for Research in Stereo Modeling in various aspects of computer science.

For more information, access the research section of the Web site at cse.asu.edu.

COMPUTER SCIENCE AND ENGINEERING (CSE)

CSE 408 Multimedia Information Systems. (3)

fall

Design, use, and applications of multimedia systems. Introduces acquisition, compression, storage, retrieval, and presentation of data from different media such as images, text, voice, and alphanumeric. Prerequisite: CSE 310.

CSE 412 Database Management. (3)

fall and spring

Introduces DBMS concepts. Data models and languages. Relational database theory. Database security/integrity and concurrency. Fee. Prerequisite: CSE 310.

CSE 420 Computer Architecture I. (3)

once a year

Computer architecture. Performance versus cost tradeoffs. Instruction set design. Basic processor implementation and pipelining. Prerequisite: CSE 330.

CSE 421 Microprocessor System Design I. (4)

fall and spring

Assembly language programming and logical hardware design of systems using 8-bit microprocessors and microcontrollers. Fundamental concepts of digital system design. Reliability and social, legal implications. Lecture, lab. Fee. Prerequisite: CSE 225 or EEE 225.

CSE 422 Microprocessor System Design II. (4)

fall and spring

Design of microcomputer systems using contemporary logic and microcomputer system components. Requires assembly language programming. Fee. Prerequisite: CSE 421.

CSE 423 Microcomputer System Hardware. (3)

fall and spring

Information and techniques presented in CSE 422 are used to develop the hardware design of a multiprocessor, multiprogramming, microprocessor-based system. Fee. Prerequisite: CSE 422.

CSE 428 Computer-Aided Processes. (3)*selected semesters*

Hardware and software considerations for computerized manufacturing systems. Specific concentration on automatic inspection, numerical control, robotics, and integrated manufacturing systems. Prerequisite: CSE 330.

CSE 430 Operating Systems. (3)*fall and spring*

Operating system structure and services, processor scheduling, concurrent processes, synchronization techniques, memory management, virtual memory, input/output, storage management, and file systems. Fee. Prerequisites: CSE 330, 340.

CSE 432 Operating System Internals. (3)*fall*

IPC, exception and interrupt processing, memory and thread management, user-level device drivers, and OS servers in a modern microkernel-based OS. Prerequisite: CSE 430.

CSE 434 Computer Networks. (3)*fall and spring*

Cryptography fundamentals; data compression; error handling; flow control; multihop routing; network protocol algorithms; network reliability, timing, security; physical layer basics. Prerequisite: CSE 330.

CSE 438 Systems Programming. (3)*selected semesters*

Design and implementation of systems programs, including text editors, file utilities, monitors, assemblers, relocating linking loaders, I/O handlers, and schedulers. Prerequisite: CSE 421 or instructor approval.

CSE 440 Compiler Construction I. (3)*once a year*

Introduces programming language implementation. Implementation strategies such as compilation, interpretation, and translation. Major compilation phases such as lexical analysis, semantic analysis, optimization, and code generation. Prerequisites: CSE 340, 355.

CSE 445 Distributed Computing with Java and CORBA. (3)*fall and spring*

Frameworks for distributed software components. Foundations of client-server computing and architectures for distributed object systems. Dynamic discovery and invocation. Lecture, projects. Fee. Prerequisite: CSE 360 or instructor approval.

CSE 446 Client-Server User Interfaces. (3)*selected semesters*

Client-server model and its use in creating and managing window interfaces. Toolkits and libraries, including X11, Microsoft Foundation Classes, and Java Abstract Window Toolkit. Lecture, projects. Fee. Prerequisite: CSE 310 or instructor approval.

CSE 450 Design and Analysis of Algorithms. (3)*fall and spring*

Design and analysis of computer algorithms using analytical and empirical methods; complexity measures, design methodologies, and survey of important algorithms. Prerequisite: CSE 310.

CSE 457 Theory of Formal Languages. (3)*once a year*

Theory of grammar, methods of syntactic analysis and specification, types of artificial languages, relationship between formal languages, and automata. Prerequisite: CSE 355.

CSE 459 Logic for Computing Scientists. (3)*selected semesters*

Propositional logic, syntax and semantics, proof theory versus model theory, soundness, consistency and completeness, first order logic, logical theories, automated theorem proving, ground resolution, pattern matching unification and resolution, Dijkstras logic, proof obligations, and program proving. Prerequisite: CSE 355.

CSE 460 Software Analysis and Design. (3)*fall and spring*

Object-oriented and structured analysis and design; software architecture and design patterns; component-based development; software safety and reliability. Fee. Prerequisite: CSE 360.

CSE 461 Software Engineering Project I. (3)*fall and spring*

First of two-course software team-development sequence. Planning, management, design, and implementation using object-oriented technology, CASE tools, CMM-level-5 guidelines. Lecture, lab, oral and written communications. Fee. Prerequisite: CSE 360.

CSE 462 Software Engineering Project II. (3)*fall and spring*

Second of two-course software team-development sequence. Software evolution, maintenance, reengineering, reverse engineering, component-based development, and outsourcing. Lecture, lab, oral and written communications. Fee. Prerequisite: CSE 461.

CSE 463 Introduction to Human Computer Interaction. (3)*spring*

Design, evaluate, and implement interactive software intended for human use. Prerequisite: CSE 310.

CSE 470 Computer Graphics. (3)*fall and spring*

Display devices, data structures, transformations, interactive graphics, 3-D graphics, and hidden line problem. Fee. Prerequisites: CSE 310; MAT 342.

CSE 471 Introduction to Artificial Intelligence. (3)*fall and spring*

State space search, heuristic search, games, knowledge representation techniques, expert systems, and automated reasoning. Fee. Prerequisites: CSE 240, 310.

CSE 476 Introduction to Natural Language Processing. (3)*selected semesters*

Principles of computational linguistics, formal syntax, and semantics, as applied to the design of software with natural (human) language I/O. Prerequisite: CSE 310 or instructor approval.

CSE 477 Introduction to Computer-Aided Geometric Design. (3)*once a year*

Introduces parametric curves and surfaces, Bezier and B-spline interpolation, and approximation techniques. Prerequisites: CSE 210, 470; MAT 342.

CSE 484 Internship. (1–12)*selected semesters***CSE 507 Virtual Reality Systems. (3)***selected semesters*

Computer generated 3-D environments, simulation of reality, spatial presence of virtual objects, technologies of immersion, tracking systems. Lecture, lab. Prerequisite: CSE 408 or 470 or 508 or instructor approval.

CSE 508 Digital Image Processing. (3)*once a year*

Digital image fundamentals, image transforms, image enhancement and restoration techniques, image encoding, and segmentation methods. Prerequisite: EEE 303 or instructor approval.

CSE 509 Digital Video Processing. (3)*spring*

Concepts of digital video compression, video analysis, video indexing, browsing and retrieval, video transmission over networks, video processors, MPEG1, 2, 4, and 7 standards. Lecture, projects. Pre- or corequisite: CSE 408 or 508.

CSE 510 Database Management System Implementation. (3)*once a year*

Implementation of database systems. Data storage, indexing, querying, and retrieval. Query optimization and execution, concurrency control, and transaction management. Prerequisite: CSE 412.

CSE 512 Distributed Database Systems. (3)*once a year*

Distributed database design, query processing, and transaction processing. Distributed database architectures and interoperability. Emerging technology. Fee. Prerequisite: CSE 412.

CSE 513 Rules in Database Systems. (3)*selected semesters*

Declarative and active rules. Logic as a data model. Evaluation and query optimization. Triggers and ECA rules. Current research topics. Prerequisite: CSE 412.

GRADUATE PROGRAMS AND COURSES

CSE 514 Object-Oriented Database Systems. (3)

selected semesters

Object-oriented data modeling, definition, manipulation. Identity and inheritance. Query languages. Schema evolution. Versioning. Distributed object management. Extended relational systems. Prerequisite: CSE 412.

CSE 515 Multimedia and Web Databases. (3)

spring

Data models for multimedia and Web data; query processing and optimization for inexact retrieval; advanced indexing, clustering, and search techniques. Prerequisites: CSE 408, 412.

CSE 517 Hardware Design Languages. (3)

fall and spring

Introduces hardware design languages. Modeling concepts for specification, simulation, and synthesis. Cross-listed as EEE 517. Credit is allowed for only CSE 517 or EEE 517. Fee. Prerequisite: CSE 423 or EEE 425 or instructor approval.

CSE 518 Synthesis with Hardware Design Languages. (3)

selected semesters

Modeling VLSI design in hardware design languages for synthesis. Transformation of language-based designs to physical layout. Application of synthesis tools. Fee. Prerequisite: CSE 517.

CSE 520 Computer Architecture II. (3)

fall

Computer architecture description languages, computer arithmetic, memory-hierarchy design, parallel, vector, multiprocessors, and input/output. Prerequisites: CSE 420, 430.

CSE 521 Microprocessor Applications. (4)

selected semesters

Microprocessor technology and its application to the design of practical digital systems. Hardware, assembly language programming, and interfacing of microprocessor-based systems. Lecture, lab. Prerequisite: CSE 421.

CSE 523 Microcomputer Systems Software. (3)

selected semesters

Developing system software for a multiprocessor, multiprogramming, microprocessor-based system using information and techniques presented in CSE 421, 422. Prerequisite: CSE 422.

CSE 526 Parallel Processing. (3)

selected semesters

Real and apparent concurrency. Hardware organization of multiprocessors, multiple computer systems, scientific attached processors, and other parallel systems. Prerequisite: CSE 330 or 423.

CSE 531 Distributed and Multiprocessor Operating Systems. (3)

once a year

Distributed systems architecture, remote file access, message-based systems, object-based systems, client/server paradigms, distributed algorithms, replication and consistency, and multiprocessor operating systems. Prerequisite: CSE 432 or instructor approval.

CSE 532 Advanced Operating System Internals. (3)

selected semesters

Memory, processor, process and communication management, and concurrency control in the Windows NT multiprocessor and distributed operating system kernels and servers. Prerequisites: CSE 432, 531 (or 536).

CSE 534 Advanced Computer Networks. (3)

fall and spring

Advanced network protocols and infrastructure, applications of high-performance networks to distributed systems, high-performance computing and multimedia domains, special features of networks. Prerequisite: CSE 434.

CSE 535 Mobile Computing. (3)

spring

Mobile networking, mobile information access, adaptive applications, energy-aware systems, location-aware computing, mobile security and privacy. Prerequisite: CSE 434.

CSE 536 Advanced Operating Systems. (3)

spring

Protection and file systems. Communication, processes, synchronization, naming, fault tolerance, security, data replication, and coherence in distributed systems. Real-time systems. Fee. Prerequisite: CSE 430.

CSE 539 Applied Cryptography. (3)

spring

Use of cryptography for secure protocols over networked systems, including signatures, certificates, timestamps, electrons, digital cash, and other multiparty coordination. Prerequisite: CSE 310 or instructor approval.

CSE 540 Compiler Construction II. (3)

selected semesters

Formal parsing strategies, optimization techniques, code generation, extensibility and transportability considerations, and recent developments. Prerequisite: CSE 440.

CSE 550 Combinatorial Algorithms and Intractability. (3)

once a year

Combinatorial algorithms, nondeterministic algorithms, classes P and NP, NP-hard and NP-complete problems, and intractability. Design techniques for fast combinatorial algorithms. Prerequisite: CSE 450.

CSE 555 Theory of Computation. (3)

once a year

Rigorous treatment of regular languages, context-free languages, Turing machines and decidability, reducibility, and other advanced topics in computability theory. Prerequisite: CSE 355 or instructor approval.

CSE 562 Software Process Automation. (3)

selected semesters

Representing the software process; creating a measured and structured working environment; using, constructing, and adapting component-based tools. Prerequisite: CSE 360.

CSE 563 Software Requirements and Specification. (3)

selected semesters

Examines the definitional stage of software development; analysis of specification representations, formal methods, and techniques emphasizing important application issues. Fee. Prerequisite: CSE 460.

CSE 564 Software Design. (3)

once a year

Examines software design issues and techniques. Includes a survey of design representations and a comparison of design methods. Prerequisite: CSE 460.

CSE 565 Software Verification, Validation, and Testing. (3)

once a year

Test planning, requirements-based and code-based testing techniques, tools, reliability models, and statistical testing. Prerequisite: CSE 460.

CSE 566 Software Project, Process, and Quality Management. (3)

once a year

Project management, risk management, configuration management, quality management, and simulated project management experiences. Prerequisite: CSE 360.

CSE 570 Advanced Computer Graphics I. (3)

once a year

Hidden surface algorithms, lighting models, and shading techniques. User interface design. Animation techniques. Fractals and stochastic models. Raster algorithms. Prerequisite: CSE 470.

CSE 571 Artificial Intelligence. (3)

once a year

Definitions of intelligence, computer problem solving, game playing, pattern recognition, theorem proving, and semantic information processing; evolutionary systems; heuristic programming. Prerequisite: CSE 471.

CSE 572 Data Mining. (3)

spring

Advanced data mining techniques: classification, clustering, association, preprocessing; performance evaluation; information assurance, Web mining, security and privacy issues, and other applications. Cross-listed as CBS 572. Credit is allowed for only CBS 572 or CSE 572. Prerequisite: CSE 412 or 471 or ECE 380 (or their equivalents).

CSE 573 Advanced Computer Graphics II. (3)

selected semesters

Modeling of natural phenomena: terrain, clouds, fire, water, and trees. Particle systems, deformation of solids, antialiasing, and volume visualization. Lecture, lab. Prerequisite: CSE 470.

CSE 574 Planning and Learning Methods in AI. (3)*selected semesters*

Reasoning about time and action, plan synthesis and execution, improving planning performance, applications to manufacturing intelligent agents. Prerequisite: CSE 471 (or its equivalent).

CSE 576 Topics in Natural Language Processing. (3)*selected semesters*

Comparative parsing strategies, scoping and reference problems, nonfirst-order logical semantic representations, and discourse structure. Prerequisite: CSE 476 or instructor approval.

CSE 577 Advanced Computer-Aided Geometric Design I. (3)*once a year*

General interpolation; review of curve interpolation and approximation; spline curves; visual smoothness of curves; parameterization of curves; introduces surface interpolation and approximation. Prerequisites: both CSE 470 and 477 or only instructor approval.

CSE 578 Advanced Computer-Aided Geometric Design II. (3)*selected semesters*

Coons patches and Bezier patches; triangular patches; arbitrarily located data methods; geometry processing of surfaces; higher dimensional surfaces. Prerequisites: both CSE 470 and 477 or only instructor approval.

CSE 579 NURBS: Nonuniform Rational B-Splines. (3)*selected semesters*

Projective geometry, NURBS-based modeling, basic theory of conics and rational Bezier curves, rational B-splines, surfaces, rational surfaces, stereographic maps, quadrics, IGES data specification. Prerequisites: CSE 470, 477.

CSE 593 Applied Project. (1–12)*selected semesters***CSE 598 Special Topics. (1–4)***selected semesters*

Topics may include the following:

- Client-Server User Interfaces
Fee.
- Computational Models for the Arts. (3)
fall
Covers computability and intractability; kolmogorov complexity in the context of randomness and determinism.
- Computer Graphics
Fee.
- Database Management
Fee.
- Distributed Computing with Java and CORBA
Fee.
- Introduction to Artificial Intelligence
Fee.
- Microcomputer System Hardware
Fee.
- Microprocessor System Design I
Fee.
- Microprocessor System Design II
Fee.
- Operating Systems
Fee.
- Signal Processing and Programming for the Arts. (3)
spring
Introduces basic concepts behind the functioning of existing, widely used digital arts and media tools.
- Software Analysis and Design
Fee.
- Software Engineering Project I
Fee.
- Software Engineering Project II
Fee.

Omnibus Courses. For an explanation of courses offered but not specifically listed in this catalog, see "Omnibus Courses," page 50.

Construction**Master's Program**construction.asu.edu

480/965-3615

USE 138

William W. Badger, Director**Professor:** Badger**Associate Professors:** Ariaratnam, Bashford, Chasey, Ernzen, Kashiwagi, Sawhney, Wiesel**Assistant Professors:** Fiori, Knutson

MASTER OF SCIENCE

The faculty in the Del E. Webb School of Construction offer a graduate program leading to the M.S. degree in Construction. Concentrations are available in construction science, facilities management, and construction management. The interdisciplinary nature of the program allows a candidate's program of study to reflect both individual interests and career goals.

The primary objective of the program is to allow students with a baccalaureate degree in construction or a related field such as architecture, business, or engineering to broaden and improve their professional capabilities in construction. The program is designed to meet the growing need for professionals with advanced technical, management, and applied research skills in the construction industry.

The *construction science* concentration allows students with an interest in field engineering or supervision of heavy and industrial construction projects to pursue a more technically oriented course of study. The *facilities* (management) concentration supports the needs of the student desiring a career in the maintenance, operation, renovation, or decommissioning of existing facilities. The (construction) *management* concentration allows students seeking upper-level management positions in various sectors of the construction industry to improve their competency in project, program, and company management areas.

Admission Requirements. Applicants are expected to satisfy all requirements for admission to the Graduate College. In addition, applicants are expected to be competent in basic construction topics. Admission is based upon an evaluation of the student's academic background and potential for success. Students whose native language is not English must also submit a Test of English as a Foreign Language (TOEFL) score of at least 550.

Graduate Record Examination (GRE). Applicants must submit scores on the verbal, quantitative, and analytical sections of the GRE for admission.

GRADUATE PROGRAMS AND COURSES

Application Deadline. Completed college and departmental application materials should be received by February 1 for admission in the fall semester.

Program of Study. As soon as possible after selecting the student's supervisory committee, the student must file a program of study with the Graduate College.

The program of study consists of the following: thesis option—30 semester hours of graduate study culminating in a thesis and an oral defense; or nonthesis option—36 semester hours of graduate study culminating in an oral and written comprehensive examination.

RESEARCH ACTIVITY

Applied research is an integral part of the M.S. degree in Construction. The Del E. Webb School of Construction has several major ongoing research projects. The general fields of study include Alliance for Construction Excellence, Construction Research Education Advanced Technology Environments, Advanced Technology Homes, Performance-Based Studies Research Group, alternative project delivery systems, construction productivity studies, construction information technology, and construction and behavior of deep foundation. For more information, access the Web site at construction.asu.edu.

CONSTRUCTION (CON)

CON 424 Structural Design. (3)

fall

Economic use of concrete, steel, and wood in building and engineered structures. Design of beams, columns, concrete formwork, and connections. Lecture, field trips. Prerequisite: CON 310.

CON 453 Construction Labor Management. (3)

fall and spring

Labor and management history, union, and open shop organization of building and construction workers; applicable laws and government regulations; goals, economic power, jurisdictional disputes, and grievance procedures. Lecture, lab. Prerequisites: CON 371; ECN 112.

CON 455 Construction Project Management. (3)

fall and spring

Study of methods for coordinating people, equipment, materials, money, and schedule to complete a project on time and within approved cost. Lecture, class projects, CPC exam. Fee. Prerequisite: CON 371. Pre- or corequisite: CON 495.

CON 463 Foundations. (3)

spring

Subsurface construction theory and practice for description, excavations, exploration, foundations, pavements, and slopes. Evaluation of specifications and plans of work. Lecture, recitation, field trips. Prerequisite: CON 450.

CON 468 Mechanical and Electrical Estimating. (3)

fall

Analysis and organization of performing a cost estimate for both mechanical and electrical construction projects. Computer usage. Prerequisites: a combination of CON 273 and 345 and 383 or only instructor approval.

CON 471 Mechanical and Electrical Project Management. (3)

spring

Specialty contracts and agreements, scheduling, material handling, labor unit analysis, and job costing for mechanical and electrical construction. Prerequisite: CON 371.

CON 472 Development Feasibility Reports. (3)

fall and spring

Integrates economic location theory, development cost data, market research data, and financial analysis into a feasibility report. Computer orientation. Prerequisite: REA 380.

CON 477 Residential Construction Business Practices. (3)

fall

Topics addressed include development, marketing, financing, legal issues, and sales.

CON 483 Advanced Building Estimating. (3)

fall and spring

Concepts of pricing and markup, development of historic costs, life cycle costing, change order and conceptual estimating, and emphasizing microcomputer methods. Prerequisite: CON 383.

CON 486 Heavy Construction Estimating. (3)

fall

Methods analysis and cost estimation for construction of highways, bridges, tunnels, dams, and other engineering works. May be repeated for credit. Lecture, field trips. Prerequisites: CON 341, 383.

CON 495 Construction Planning and Scheduling. (3)

fall and spring

Various network methods of project scheduling, such as AOA, AON Pert, bar-charting, line-of-balance, and VPM techniques. Microcomputers used for scheduling, resource allocation, and time/cost analysis. Lecture, lab. Fee. Prerequisites: CON 383; STP 226. Pre- or corequisite: CON 389.

CON 496 Construction Contract Administration. (3)

fall and spring

Surveys administrative procedures of general and subcontractors. Studies documentation, claims, arbitration, litigation, bonding, insurance, and indemnification. Discusses ethical practices. Lecture, field trips. Prerequisites: COM 225 or ECE 300; senior standing.

CON 533 Strategies of Estimating and Bidding. (3)

fall

Explores advanced concepts of the estimating process, such as modeling and statistical analysis, to improve bid accuracies. Prerequisite: CON 483 or 486 or instructor approval.

CON 540 Construction Productivity. (3)

fall

Productivity concepts. Data collection. Analysis of productivity data and factors affecting productivity. Means for improving production and study of productivity improvement programs. Pre- or corequisite: CON 495.

CON 543 Construction Equipment Engineering. (3)

spring

Analyzes heavy construction equipment productivity using case studies. Applies engineering fundamentals to the planning, selection, and utilization of equipment. Lecture, case studies.

CON 545 Construction Project Management. (3)

spring

Theory and practice of construction project management. Roles of designer, owner, general contractor, and construction manager. Lecture, field trips. Pre- or corequisite: CON 495.

CON 547 Strategic Planning. (3)

fall

Business planning process of the construction enterprise. Differences between publicly held and closely held businesses and their exposure.

CON 551 Alternative Project Delivery Methods. (3)

fall

Design/construction interaction; conceptual estimation and scheduling; the RFQ/RFP process; legal, insurance, risk allocation issues; procurement and selection.

CON 561 International Construction. (3)

spring

Investigation of the cultural, social, economic, political, and management issues related to construction in foreign countries and remote regions.

CON 565 Performance-Based Systems. (3)

fall

Identifying the multicriteria methodology in the procurement of facilities contractual work. Prerequisite: instructor approval.

CON 567 Advanced Procurement Systems. (3)

spring

Development of multicriteria decision procurement model for selecting the performing contractor. Prerequisite: instructor approval.

CON 570 Cleanroom Construction I. (3)*fall*

Design issues for cleanroom facilities; the construction's viewpoint, including planning, structures, mechanical, and tool installation. Lecture, site visits. Prerequisite: instructor approval.

CON 571 Cleanroom Construction II. (3)*spring*

Construction issues for cleanroom facilities, including scheduling, cost estimating, project management, mechanical, safety certification, and tool hook-up. Lecture, site visits. Prerequisite: CON 570 or instructor approval.

CON 575 Information Technology in Construction. (3)*spring*

Use of information technology in the construction enterprise for improved communications, process modeling, and decision making. Prerequisite: instructor approval.

CON 589 Construction Company Financial Control. (3)*fall*

Financial accounting and cost control at the company level in construction companies. Accounting systems. Construction project profit calculations. Financial analysis. Lecture, case studies.

Omnibus Courses. For an explanation of courses offered but not specifically listed in this catalog, see "Omnibus Courses," page 50.

Counseling

Master's Program

coe.asu.edu/psyched

480/965-6339

EDB 446

Patricia Arredondo, Academic Program Leader

Professors: Bernstein, Claiborn, Hackett, Horan, Kerr, Kinnier, Robinson Kurpius, Tracey

Associate Professors: Abreu, Arciniega, Arredondo, Hood

Assistant Professor: Rayle

Clinical Associate Professor: Homer

Clinical Assistant Professor: Glidden-Tracey

MASTER OF COUNSELING

The Master of Counseling (M.C.) degree is a two-year, 60-semester-hour professional program. The program is designed to prepare students for counseling as a profession, and it includes a set of required professional studies supported by elective subjects in related disciplines. Practitioner, research, and school counseling options are available. The M.C. program, which is in community counseling, is accredited by the Council for Accreditation of Counseling and Related Educational Programs (CACREP). The school counseling option is appropriate for school counselor certification in Arizona and other states.

The M.C. degree identifies the recipient as a professional counselor and prepares individuals to work in a variety of human service fields.

Admission. A student initiates application for admission to the M.C. degree program with the Graduate College.

Admission is determined by a variety of criteria in addition to GPAs. Applications are reviewed once a year. Applicants to the M.C. degree must submit all application materials before January 15 to be considered for admission for the following academic year. The number of students admitted to the M.C. degree program is limited by the size of the faculty and the facilities available for practica. Applicants may get the complete program brochure from the Division of Psychology in Education and the program Web site, coe.asu.edu/psyched.

Supervisory Committee. Following admission to the M.C. program, a supervisory committee consisting of a chair and two other faculty members are appointed to plan a program of study with the student.

Program of Study. The program of study should be planned in consultation with the supervisory committee. Candidates for the M.C. degree must complete COE 501 Introduction to Research and Evaluation in Education. In addition to course work, the program may include supervised practica in consultation, individual and group counseling, marriage and family counseling, and stress management. These experiences involve a variety of client populations. The program of study must be approved by the supervisory committee, the division director, and the dean of graduate studies.

Credit Before Admission. A maximum of 32 semester hours of graduate course work earned in a completed master's degree from an accredited institution may be applied to the program. In all other circumstances, a maximum of nine semester hours of prior course work may be applied to the M.C. degree program.

Final Examinations. Students in the practitioner option are required to take a final written comprehensive examination.

Students in the research option are required to complete a thesis. An oral examination in defense of the thesis is also required.

RESEARCH ACTIVITY

See "Counseling Psychology," page 170, for research activity.

COUNSELOR EDUCATION (CED)

CED 512 Introduction to Helping Relationships. (3)

fall, spring, summer

Introduces the skills used in the helping professions and examines the settings in which they occur.

CED 522 Theories of Counseling and Psychotherapy. (3)

fall, spring, summer

Presents major theories of psychological intervention as well as underlying personality theory upon which they are based.

CED 523 Psychological Tests. (3)

fall, spring, summer

Standardized tests in the study of the individual, with emphasis on test score interpretation in counseling. Prerequisite: COE 502 (or its equivalent).

GRADUATE PROGRAMS AND COURSES

CED 527 Community Counseling. (3)

fall and summer

Community focus with emphasis on outreach, prevention, psychoeducation, consulting, and advocacy from a systematic multicultural perspective. Lecture, discussion, visitations, experiential activities.

CED 528 School Counseling. (3)

fall, spring, summer

Introduces counseling within multicultural settings. Emphasizes counseling, consultation, and coordination skills needed for schools' comprehensive developmental guidance programs. Lecture, discussion, experiential activities.

CED 534 Occupations and Careers. (3)

fall, spring, summer

The world of work, career development, education, and training for occupational entry and mobility.

CED 545 Analysis of the Individual. (3)

fall, spring, summer

Theory and methods commonly used in studying the individual. Observational methods, diagnostic interviews, structured, and semi-structured methods for assessing personality.

CED 567 Group Dynamics and Counseling. (3)

fall, spring, summer

Group process factors, theory, and diversity issues determining effective interaction in small groups. Emphasis placed on lecturettes, self awareness, and experiential components. Lecturettes, discussion, experiential activities. Prerequisite: admission to graduate degree program.

CED 577 Counseling Prepracticum. (3)

fall, spring, summer

Focus on racial, social, and cultural factors in the development of helping relationships through integration of cognitive and affective self-awareness with counseling skills. Lecture, lab. Prerequisite: admission to M.C. or school counselor certification program. Pre- or corequisite: CED 522.

CED 655 Student Development Programs in Higher Education. (3)

once a year

Emerging conceptual models of student development. Overview of student personnel and student affairs programs in community colleges, four-year colleges, and universities. Observation on campuses.

CED 672 Marriage and Family Counseling. (3)

fall

Introduces marriage and family counseling theories. Emphasizes a systems-communication model utilizing cocounseling.

CED 680 Practicum. (1-12)

selected semesters

CED 684 Internship in Community and/or School Counseling. (3-6)

fall, spring, summer

Prerequisites: CED 680; instructor approval.

Omnibus Courses. For an explanation of courses offered but not specifically listed in this catalog, see "Omnibus Courses," page 50.

Counseling Psychology

Doctoral Program

coe.asu.edu/psyched

480/965-6339

EDB 446

Richard T. Kinnier, Training Director

Patricia Arredondo, Academic Program Leader

Professors: Bernstein, Claiborn, Hackett, Horan, Kerr, Kinnier, Robinson Kurpius, Tracey

Associate Professors: Abreu, Arciniega, Arredondo, Hood

Assistant Professor: Rayle

Clinical Associate Professor: Homer

Clinical Assistant Professor: Glidden-Tracey

DOCTOR OF PHILOSOPHY

The faculty in the Division of Psychology in Education offer a graduate program leading to the Ph.D. degree in Counseling Psychology. The Ph.D. program in Counseling Psychology is accredited by the American Psychological Association. The Ph.D. program adheres closely to the scientist-practitioner model in preparing graduates for positions in academic and psychological service settings. Although faculty interests are diverse, there is a strong emphasis on empirical data as the basis for professional decision making. All applicants must submit scores of the Graduate Record Examination and submit all application materials before December 1 to be considered for admission for the following academic year.

Curriculum requirements of the Counseling Psychology program include course work from several domains (general psychology core, empirical foundations, and counseling theory and methods), as well as practicum and internship experiences. Comprehensive examinations cover the psychology core, empirical foundations, and counseling theory and practice. Applicants should contact the Division of Psychology in Education and request the Counseling Psychology Program brochure for a complete description of admissions and curricular requirements. A copy of the program brochure is also available on the Web site, coe.asu.edu/psyched.

RESEARCH ACTIVITY

Research activity includes career development and self-efficacy, counseling process, drug abuse prevention, adolescent suicide, problem solving and decision making, small-group process, interpersonal skill development, ethnic and gender issues, health psychology topics, student development, program evaluation, gerontological

counseling, ethics, marriage and family counseling, at-risk youth, and the counseling of the gifted and talented.

COUNSELING PSYCHOLOGY (CPY)

CPY 613 Child Counseling. (3)

selected semesters

Applications of counseling theory in working with children in clinics and elementary schools. Integrated practicum available with instructor approval. Prerequisite: CED 577 (or its equivalent).

CPY 622 Group Counseling. (3)

fall and spring

Theories and methodologies used in group counseling. Prerequisites: CED 567 and 577 (or their equivalents).

CPY 634 Organizational Development and Planned Change. (3)

selected semesters

Organizational/individual dynamics, including theory, analysis, techniques, and consultation/intervention strategies used in organizational development. Field consultation projects. Prerequisites: CED 567 and 577 (or their equivalents).

CPY 644 Psychology of Careers. (3)

spring

Advanced career counseling, including theory, research, and practice. Prerequisite: CED 577 (or its equivalent).

CPY 645 Professional Issues and Ethics. (3)

fall and spring

Ethical, legal, and professional issues of concern to practitioners and researchers functioning in a variety of settings.

CPY 667 Patterns of Behavior Disorders. (3)

once a year

Etiology and treatment of a variety of psychological problems, particularly those represented in DSM III-R. Prerequisite: CED 577 (or its equivalent).

CPY 671 Multicultural Counseling. (3)

fall

Provides awareness of the influence of sociocultural variables on human development and explores implications for counseling minority populations.

CPY 672 Human Diversity: Social Psychological Perspectives. (3)

once a year

Implications for psychological practice of social, psychological, and biological factors in the development of behavioral differences.

CPY 674 Counseling Women. (3)

fall

Explores women's development and its implications for counseling. Sexism in mental health, sex differences in diagnosis and psychopathology, and women's particular treatment needs.

CPY 675 Health and Wellness Counseling. (3)

selected semesters

Theory, research, and practice in health and wellness counseling.

CPY 677 Advanced Counseling. (3)

selected semesters

Advanced topics in counseling theory, research, and practice. Prerequisite: CED 577 (or its equivalent).

CPY 679 History and Systems of Psychology. (3)

once a year

Examines the development and differentiation of the discipline of psychology from its origins in philosophy to the present.

CPY 701 Science and Practice of Counseling Psychology. (3)

fall

Directed experiences involving the integration of theory, research, and practice in counseling psychology. Prerequisite: instructor approval.

CPY 702 Research Methods in Counseling Psychology. (3)

once a year

Applies experimental and/or quasi-experimental methods to theory construction and treatment evaluation in counseling psychology. Prerequisite: COE 502 (or its equivalent).

Omnibus Courses. For an explanation of courses offered but not specifically listed in this catalog, see "Omnibus Courses," page 50.

Counselor Education

Master's Program

coe.asu.edu/psyched

480/965-6339

EDB 446

Patricia Arredondo, Academic Program Leader

Professors: Bernstein, Claiborn, Hackett, Horan, Kerr, Kinnier, Robinson Kurpius, Tracey

Associate Professors: Abreu, Arciniega, Arredondo, Hood

Assistant Professor: Rayle

Clinical Associate Professor: Homer

Clinical Assistant Professor: Glidden-Tracey

The faculty in the Division of Psychology in Education offer a degree program leading to the Master of Education (M.Ed.) degree in Counseling.

MASTER OF EDUCATION

The M.Ed. degree in Counseling is a 30-semester-hour program for certified or certifiable teachers. The degree is designed to provide a greater understanding of the psychological and behavioral development of individual students; the dynamics and use of groups in the instructional process; principles of testing and vocational and career dynamics that have applications in the instructional process; the effective utilization of school specialists in aiding student development; and the role of the school counselor in the instructional process. While the M.Ed. program is generally chosen as a student's fifth year of teacher preparation, the M.Ed. does not result in certification as a school counselor. Those wishing to be certified for school counseling should apply to the Master of Counseling (M.C.) degree program.

Admission to the M.Ed. in Counseling is based on the applicant's potential for graduate study and completion of an undergraduate degree in education or certification as a teacher in Arizona public schools. To balance student demand with resources available, the program is limited in the number of students admitted each admissions period.

Applicants must submit all application materials before October 15 or April 15 to be considered for admission for the following semester. Applicants should get the complete program brochure from EDB 302 or from the Web site. For more information, see "Master of Education," page 189.

RESEARCH ACTIVITY

See "Counseling Psychology," page 170.

COURSES

For courses, see "Counseling," page 169.

Creative Writing

Interdisciplinary Master's Program

www.asu.edu/clas/english/creativewriting

480/965-3528

LL 307C

Melissa Pritchard, Director, Executive Committee

English

Regents' Professors: Carlson, Dubie, Ríos

Professors: Boyer, Goldberg, Hogue, McNally, Rhodes

Associate Professors: Pritchard, Savard

Senior Lecturer: Cook

Theatre

Professors: Bedard, Knapp

Associate Professors: Edwards, Reyes

Assistant Professor: Sterling

Faculty of the Creative Writing Committee offer an interdisciplinary Master of Fine Arts degree in Creative Writing. The program is offered jointly by the Department of English in the College of Liberal Arts and Sciences and the Department of Theatre in the Katherine K. Herberger College of Fine Arts.

MASTER OF FINE ARTS

One of the unique features of this interdisciplinary program is that, because it utilizes faculty research, creative activity, and teaching interests of two academic units, a student may tailor a course of study to fit individual needs, talents, and goals. The Department of English administers the program and reviews the applications for admission. In the English Department, the studio/academic program requires poets and prose writers to divide work equally between writing workshops and literature courses. This flexible curriculum allows candidates time to study with several gifted writers and scholars in a stimulating atmosphere, time to get quality advice on writing, and time to explore and develop their talents. In the Department of Theatre, the studio/academic program emphasizes the collaborative process of playwriting. Working with actors and directors, playwrights' workshops include informal readings, staged readings and workshop production of students' plays.

Admission. In addition to meeting the general requirements of the Graduate College, applicants must have an undergraduate major in English or Theatre, with a GPA of 3.00 or above. Applicants who do not have an undergraduate major in English or Theatre may be admitted provisionally, on the condition that they make up deficiencies in course work. Deficiencies in undergraduate preparation may be removed while pursuing the M.F.A. degree; courses taken to remove deficiencies may not be counted toward the degree. Applicants must also submit the following:

1. an acceptable score on the Miller Analogies Test or the Graduate Record Examination (GRE);
2. three letters of recommendation;
3. a professional résumé; and
4. a statement of career goals, including the designation of an area of specialization (options include fiction, poetry, and playwriting) and a manuscript sample of one of the following: 30 pages of drama; 20 pages of poetry; 30 pages of prose fiction or creative nonfiction; or 40 total pages of work in two of these literary forms.

Selection Procedures. Completed application forms should be sent directly to the Graduate College. All other materials and manuscripts, including the teaching assistant application form, should be submitted to the Department of English by February 1. The Creative Writing Committee reviews the materials and manuscripts and makes recommendations for admission by March 15. Guidelines for admission recommendations used by the committee include the following: applicant's academic record and capabilities for successful graduate study; talent and promise demonstrated in the manuscript sample; strength of letters of recommendation; quality of applicant's undergraduate background; and compatibility of the applicant's career goals with the purpose of the degree program.

Program of Study. In poetry and fiction, the program of study requires a minimum of 48 semester hours of graduate credit approved by the student's supervisory committee, the director of the Creative Writing Committee, and the dean of graduate studies. Of these, 24 semester hours must be creative writing courses and must include nine semester hours of ENG 580, and nine semester hours of any combination of ENG 455, 562, 563, 594, 598, 662, 663, and 664. The course 594 Conference and Workshop may be taken twice to varied offerings. The literature component of 24 semester hours must include ENG 591, 665, and two ENG courses in literature selected by the student's supervisory committee or the director of the creative writing committee such as ENG 667. In playwriting, the program of study requires a minimum of 60 semester hours of graduate credit approved by the student's supervisory committee, the director of the Creative Writing Committee, and the dean of graduate studies. The program of study must include the following: THP 519 (six semester hours), 560 (15 semester hours), 561 (three semester hours), 598 (three semester hours), and 693 (nine semester hours). The literature component of 30 semester hours must include THE 500, 504, 505, 520, and 521.

Credit Before Admission. Subject to the recommendation of the supervisory committee, students with a completed M.A. or Ph.D. degree in English or Theatre may have up to 15 semester hours of literature credit applied to the M.F.A. program of study. A maximum of nine semester hours taken before admission and not as part of a completed degree at ASU and/or another institution may be used to fulfill degree requirements. All course work for the degree must be completed within the six-year time limit.

Comprehensive Examinations. A final written comprehensive examination is required and is scheduled once each semester and once during the summer. Upon completion of course work, the student is required to take the written examination. Official application is made through the Graduate College. The student is also required to notify the Creative Writing Committee of intent to take the examination at least 30 days in advance. A student is not eligible to apply for the written examination until a program of study has been filed. If the candidate fails the examination, a reexamination may be administered no sooner than three months and no later than one year from the date of the original examination. Permission for reexamination must be obtained from the student's supervisory committee, the director of the Creative Writing Committee, and the dean of graduate studies. Only one reexamination is permitted. Students are examined in the following areas:

1. 20th-century American writers: modern period;
2. 20th-century writers: contemporary period; and
3. 20th-century critical theory.

Playwrights are examined in the following areas: (1) European and American drama and (2) dramatic theory and criticism. The examination is constructed and graded by members of the Creative Writing Examination Committee.

Practicum and Performance Requirements. ENG 580 Practicum or THP 693 Applied Project is required of all students in the program. For nine semester hours of credit, the student creates a book-length volume of poetry, short stories, novel, drama, translation, or creative nonfiction (except literary criticism). This project must be approved in advance by the student's supervisory committee on the basis of sample pages and a summary of the proposal. The supervisory committee must evaluate and approve the final project. As the last requirement for the degree, the candidate must read or perform from the practicum or applied project before students and members of the faculty.

RESEARCH AND SCHOLARLY ACTIVITY

Research and scholarly endeavors inform the creative work of the faculty, which includes publication of poetry, fiction, and drama; collaborative production with musicians, fine printers, and visual artists. Special research courses are offered on contemporary perspectives emphasizing such topics as "Magical Realism," "The Long Poem," "Pedagogy Forum for Creative Writers," "The Literature of Obsession," "Sexing the Modern," "Internship for Community Outreach," "Death and Transfiguration," "Poetry as Witness," and "Latino and Latina Theatre."

Research and creative activity is enhanced by vigorous faculty and student involvement in producing a national literary magazine, *Hayden's Ferry Review*, an ASU student publication. Creative writing faculty and graduate students participate in public outreach programs, including workshops at ASU for adults and high school students in rural and metropolitan areas of the region. Public lectures and readings by faculty members, original play productions and reader's theatre, and a regular series of public readings, lectures and conferences featuring writers of national renown provide a forum for exchange among artist, audience,

scholar, and student. Recent conferences, with support from the National Endowment for the Arts and other agencies, have brought together writers, editors, and publishers, focusing attention on issues in publishing creative work.

COURSES

For courses, see "English (ENG)," page 208, "Theatre (THE)," page 355, and "Theatre Performance and Production (THP)," page 356.

Criminal Justice

Master's Program

ASU West offers a Master of Arts degree in Criminal Justice. For information, see the *ASU West Catalog*, call 602/543-4567, or access www.west.asu.edu on the Web.



Hopi Flute Player is one of many sculptures on ASU Main campus.

Angela Reaburn photo

Curriculum and Instruction

Master's and Doctoral Programs

coe.asu.edu/programs

480/965-4602

ED 434

Thomas E. Barone, Interim Director

**Robert B. Rutherford Jr., Associate Director
of Research and Graduate Education**

Professor and Endowed Chair: Tobin

Professors: Appleton, Baker, Barone, Bitter, Christie, Edelsky, Faltis, Flores, E. Garcia, Gryder, Guzzetti, Hudelson, Ovando, Rutherford, Searfoss, Stahl, Surbeck, Swadener, Zucker

Associate Professors: Anijar, Arias, Blumenfeld-Jones, Cohn, Di Gangi, Gomez, McCoy, Middleton, Rader, Smith, Vallejo

Assistant Professors: Baek, Clark, Fischman, Lamorey, MacSwan, Manuelito, Martinez-Roldan, Rolstad, Young

Clinical Associate Professors: P. Garcia, Mathur

Clinical Assistant Professor: Christine

Lecturers: Atkinson, Burstein, Cocchiarella, Devitt, Harrison, Kastre, Kortman, Maderazo, Roanhorse-Dineyazhe, Rutowski, Soroka, Spanias, Stahlman

Administrative Professional: Enz

The faculty of the Division of Curriculum and Instruction offer the Master of Arts, Master of Education, and Doctor of Education degree programs in Curriculum and Instruction.

The Ph.D. degree in Curriculum and Instruction is offered by the Interdisciplinary Committee on Curriculum and Instruction. See "Interdisciplinary Doctoral Program," page 179, for information regarding the Ph.D. curriculum.

Graduate-level endorsement programs in bilingual education, English as a second language, and reading are available and may be completed in conjunction with an M.Ed. or the Postbaccalaureate Program for Initial Teacher Certification.

M.A. and M.Ed. students majoring in Curriculum and Instruction complete requirements by choosing one of the following concentrations: bilingual education, early childhood education, elementary education, English as a second language, language and literacy, Indian education, mathematics education, science education, secondary education, and social studies education. A concentration in professional studies is available under the M.Ed.

The Ed.D. degree in Curriculum and Instruction offers areas of concentration in bilingual education, curriculum

studies, early childhood education, English as a second language, Indian education, language and literacy, mathematics education, and social studies education. Applications for the concentrations in elementary education and secondary education are not being accepted at this time.

Admission. Applicants for admission to the M.Ed. and M.A. degrees are required to

1. meet Graduate College requirements for admission,
2. provide letter of intent that includes a statement of purpose and a summary of the applicant's professional teaching experience, and
3. provide three letters of recommendation.

Applicants who have junior-senior GPAs of 3.00 or higher, have an acceptable application package, are not required to take the Graduate Record Examination or Miller Analogies Test. Applicants who do not meet this minimum GPA requirement should call the Division of Curriculum and Instruction graduate programs office for more information at 480/965-4602.

For admission to the Ed.D. degree program, contact the Division of Curriculum and Instruction graduate programs secretary for information regarding specific test scores and materials that need to be submitted with applications.

Applicants should note that meeting minimal admissions requirements does not guarantee admission. In addition, international students are required to submit the Test of English as a Foreign Language scores.

Programs of Study. The M.Ed. degree requires 30 semester hours of graduate course work and completion of a culminating activity. Students have two options for a culminating activity: either an applied project and an oral defense or a written comprehensive exam. Students should meet with their advisor early in their program to discuss the culminating activity.

The M.A. degree requires a minimum of 30 semester hours of graduate course work, including a thesis. An oral examination in defense of the thesis is required.

Candidates for the Ed.D. degree are required to complete at least 90 hours of graduate course work and research and dissertation credit.

Endorsements. The Arizona Reading endorsement requires 15 semester hours of upper-division or graduate-level course work in reading. The teaching endorsements in bilingual education and English as a second language require 21 semester hours. Middle school endorsement requirements include six semester hours of upper-division or graduate course work in middle-level education along with student teaching within fifth through ninth grades or one year of verifiable, full-time teaching experience within fifth through ninth grades. A valid Arizona teaching certificate is required to secure each of the above endorsements.

Initial Teacher Certification Program. The Initial Teacher Certification (ITC) program is for students who have completed a baccalaureate degree with a major other than education. The program offers course work needed to qualify for Arizona teacher certification. ITC programs are offered in early childhood education, elementary education,

multilingual/multicultural education, secondary education and special education. Concurrent admission to the M.Ed. program in special education and the ITC program is required for those seeking certification by the State of Arizona. The admission requirement for the ITC in Special Education is waived for applicants who have already completed a master's degree.

A maximum of nine semester hours completed after receiving a bachelor's degree and before formal admission to a graduate program may be applied to an M.Ed. or M.A. degree. The maximum time limit for the program of study is six years.

Prospective ITC students should call 480/965-5555, or visit the Office of Student Services in EDB LI-13, for information about specific admission requirements.

MASTER OF ARTS

See "Master's Degrees," page 94, for general requirements.

MASTER OF EDUCATION

M.Ed. students in the secondary education concentration who are certified teachers may select a general or academic specialization option. Those selecting the academic specialization option complete 15 semester hours of core and secondary education course work and 15 hours in their academic specialization. The 15 hours of course work in the academic area must be selected in consultation with a faculty member involved in the area of study. This person serves as cochair of the student's supervisory committee.

DOCTOR OF EDUCATION

The Doctor of Education (Ed.D.) program is designed to provide an opportunity for practitioner-scholars to expand their skills and knowledge related to curriculum and instruction. The program produces practitioner-scholars for leadership roles in curriculum, program evaluation, or teacher education and professional development in school. Students choose one of the curriculum and instruction concentration areas. The program prepares students for comprehending, interpreting, and applying theories, models, and research methods that have application to curriculum and instruction.

See "Doctor of Education," page 190, for information on the Doctor of Education degree.

RESEARCH ACTIVITY

Current faculty research activities include the e-learning network: learning anytime anywhere; family-centered early identification of children with learning disabilities and behavior disorders; bilingual/English as a second language/special education; Arizona behavior initiative: creating school environments that support high academic standards for all students; relationship-based practice in early intervention settings; explaining low achievement in limited English proficient students; and extending and sustaining use of reforms in mathematics classrooms.

BILINGUAL EDUCATION (BLE)

BLE 511 Introduction to Language Minority Education. (3)

once a year

Historical, philosophical, theoretical, and pedagogical foundations of language minority education in the United States.

BLE 514 Bilingual/Multicultural Aspects of Special Education. (3)

spring

Theories and issues related to the education of bilingual and culturally diverse exceptional children.

BLE 515 Instructional Methods for Bilingual Students. (3)

fall

Introduces general dual language teaching approaches and assessment strategies. Focuses on the effective teaching of limited-English-proficient populations.

BLE 520 ESL for Children. (3)

spring

Examines approaches to second language development and assessment for children congruent with recent research in second language acquisition in children.

BLE 521 Primary/Elementary Communication Arts in Bilingual Education. (3)

spring

Examines bilingual/biliterate development of elementary school children, bringing together native and second language, oral language, and literacy development findings with educational practices.

BLE 522 Literacy/Biliteracy Development. (3)

fall

Acquaints teachers with first- and second-language literacy research, practice, and assessment in elementary school settings (Spanish-English emphasis). Lecture, discussion. Cross-listed as RDG 522. Credit is allowed for only BLE 522 or RDG 522.

BLE 524 Secondary Sheltered ESL Content Teaching. (3)

fall

Teaching and assessing ESL adolescents in the content areas with an emphasis on integrating language acquisition principles with content learning. Lecture, small group work.

BLE 528 Social Studies for Bilingual/ESL Teachers. (3)

spring

Provides language and instructional methodologies and assessment strategies relevant to bilingual/multicultural students in social studies content delivered in Spanish and English.

BLE 533 Literacy in Secondary BLE/ESL Settings. (3)

spring

Examines first- and second-language literacy research, practice, and assessment across content areas in secondary school settings. Lecture, discussion. Cross-listed as RDG 533. Credit is allowed for only BLE 533 or RDG 533.

BLE 535 Sociolinguistic Issues in Bilingual Education. (3)

fall

Survey of major theoretical issues (e.g., language situations, communicative competence, language attitudes) interrelating language, social processes, and bilingual education.

BLE 541 Nature of Bilingualism/Second Language Acquisition. (3)

once a year

Bilingual and second language acquisition, with emphasis on children and adolescents. Stresses cognitive, social, and cultural aspects.

BLE 543 Bilingual Education Models. (3)

once a year

Bilingual education programs in other countries; analysis of political, social, economic, and educational implications; practice in planning bilingual education curricula. See also offerings under MCE, SED, SPE, and SPF.

BLE 561 Parent Involvement in Language Minority Education Programs. (3)

fall and spring

Examines issues, approaches, and strategies for improving parental and community involvement in the schooling of language minority children and youth.

GRADUATE PROGRAMS AND COURSES

BLE 565 Literature for Hispanic Youth/Literatura para Jóvenes Hispanoparlantes. (3)

spring

Selects, analyzes, and utilizes literature for Hispanic and Spanish-speaking children and adolescents. Lecture, discussion. Cross-listed as LIS 565/RDG 565. Credit is allowed for only BLE 565 or LIS 565 or RDG 565.

BLE 578 Student Teaching in the Elementary School. (3–15)

fall and spring

Supervised teaching in the area of specialization. Synthesized experience in curriculum instruction and classroom management in a BLE/ESL setting. Fee. Prerequisite: ITC admission.

BLE 580 Practicum. (1–6)

fall and spring

Provides for practical application in school settings of principles of BLE/ESL. Prerequisite: instructor approval.

Omnibus Courses. For an explanation of courses offered but not specifically listed in this catalog, see "Omnibus Courses," page 50.

BUSINESS EDUCATION (BUE)

BUE 480 Teaching Business Subjects. (3)

fall and spring

Organization and presentation of appropriate content for business subjects in the secondary school.

BUE 481 Technology in Business and Vocational Education. (3)

fall and spring

Emerging curricula and instructional technology in business and vocational education. Lecture, hands-on computer instruction.

BUE 502 Organization and Management of Cooperative Programs. (3)

fall

Work-study programs for business occupations in high schools and community colleges.

BUE 505 Current Literature in Business and Vocational Education. (3)

spring

Critical analyses, generalizations, and trends in business and vocational education.

Omnibus Courses. For an explanation of courses offered but not specifically listed in this catalog, see "Omnibus Courses," page 50.

CURRICULUM AND INSTRUCTION (DCI)

DCI 510 Teacher as Researcher. (3)

fall, spring, summer

Introduces teacher research as a new research genre; offers teachers guidance on planning and conducting research on their practice. Lecture, workshop.

DCI 511 Establishing Effective Teaching Practice. (2–3)

fall and spring

Helps beginning teachers establish and strengthen best practices. Interactive.

DCI 512 Developing Strategies for Teaching Practice. (2–3)

fall and spring

Helps beginning teachers refine management strategies and instructional methods. Interactive.

DCI 520 Teaching Standards Applied to Professional Practice. (1–3)

fall and spring

Develops teacher skills and self-reflective practices to assess instruction and document and achieve professional growth in teaching standards. Interactive.

DCI 521 Reflective Practice in Teaching Standards. (1–3)

fall and spring

Teachers apply reflective practices to develop professional presentation portfolios. Interactive.

DCI 530 Establish a Mentoring Partnership. (2–3)

fall and spring

Prepares veteran educators for mentoring. Mentors collaborate, reflect on their practice, and become teacher leaders through professional development. Interactive.

DCI 531 Analyzing and Planning for Professional Growth Through Mentoring. (2–3)

fall and spring

Refines strategies for assessing instruction and provides collegial feedback. Interactive.

DCI 591 Seminar. (1–12)

selected semesters

DCI 701 Curriculum Theory and Practice. (3)

fall and spring

Curriculum theory and practice as a field of study. Its current orientations and applications, modes of inquiry, and community of scholars and practitioners. Seminar. Corequisite: master's-level curriculum course.

DCI 702 Interdisciplinary Research Seminar. (3)

fall and spring

Core research course for students in the interdisciplinary Ph.D. in Curriculum and Instruction program.

DCI 791 Seminar. (1–12)

selected semesters

Topics may include the following:

- Interdisciplinary Research Seminar. (3)

Omnibus Courses. For an explanation of courses offered but not specifically listed in this catalog, see "Omnibus Courses," page 50.

EARLY CHILDHOOD EDUCATION (ECD)

ECD 501 Interprofessional Collaboration. (3)

fall

Dispositions, knowledge, experiences, and skills necessary for interprofessional collaboration required of professionals who work with multineed families with young children. Preparation to implement effective strategies and workable plans to support interprofessional collaboration for providing integrative services to young children and their families.

ECD 521 Primary/Elementary Communication Arts in Bilingual Education. (3)

spring

Examines bilingual/biliterate development of elementary school children, bringing together native and second language, oral language, and literacy development findings with educational practices.

ECD 522 Developmental Social Experiences in Early Childhood Education. (3)

fall

Materials, techniques, aesthetic expression, creative activities, and values in the integrated curriculum.

ECD 525 Emergent Literacy. (3)

spring

Examines recent research on oral language and literacy development and effective strategies for teaching language and literacy in prekindergarten to grade 3. Lecture, discussion. Cross-listed as RDG 525. Credit is allowed for only ECD 525 or RDG 525.

ECD 527 Mathematics in Early Childhood Education. (3)

fall

Theory and practice in the use of manipulative materials for teaching mathematics to preschool and primary grade children.

ECD 544 Play Education. (3)

spring and summer

Theories of play and the educational implications of each. Practical applications at the early childhood level.

ECD 555 Modern Practices in Early Childhood Education. (3)

fall and summer

Trends and practices, instructional and resource materials, and methods and techniques in early childhood education.

ECD 601 Theories and Issues in Early Childhood Education. (3)

fall and summer

Current theories and issues in early childhood education. Presents issues of early childhood best practices, policy, theory, research, and evaluation that are of significance to the early childhood professional. Highlights building on the child development conceptual framework as related to theory and practice.

ECD 733 Social and Emotional Development. (3)

once a year

Inquiry into the social and emotional development dynamics in children, such as peer relationships, self-concept, and parenting processes, with implications for teachers.

ECD 744 Evaluative Procedures: Young Children. (3)

spring

Critical examination and use of developmentally appropriate evaluative procedures for children from birth through age 8.

Omnibus Courses. For an explanation of courses offered but not specifically listed in this catalog, see "Omnibus Courses," page 50.

ELEMENTARY EDUCATION (EED)

EED 511 Principles of Curriculum Development. (3)

fall, spring, summer

Contemporary curriculum theories. Curriculum as an interrelated entity. Principles of conceiving and effecting change.

EED 526 Communication Arts in the Elementary School. (3)

spring and summer

Critical examination of school language arts teaching, focusing on theoretical assumptions regarding oral- and written-language development.

EED 528 Social Studies in the Elementary School. (3)

fall and summer

Problems and trends of current programs. Development of a balanced and articulated program of social studies.

EED 529 Science in the Elementary School. (3)

spring

Problems and trends of current programs. Development of a balanced and articulated science program.

EED 530 Outdoor/Environmental Education. (3)

summer

Use of various outdoor settings as laboratories for classroom-related experience, study, observation, inquiry, research, and recreation. Includes strategies and materials for developing environmental literacy.

EED 537 Mathematics in the Elementary School. (3)

fall and summer

Contemporary mathematics teaching. Content, materials, and approaches to instruction.

EED 538 Teaching Social Studies with Literature. (3)

fall and summer

Develops the rationale, resources, and strategies for adopting a literature-based approach to social studies teaching in grades K–8. Lecture, discussion, cooperative learning.

EED 578 Student Teaching in the Elementary School. (3–15)

fall and spring

Supervised teaching for postbaccalaureate students, synthesized experience in curriculum, instruction, and classroom management. Fee. Prerequisites: completion of 21 hours of identified course work from an approved program of study; GPA of 2.50 (postbaccalaureate nondegree) or 3.00 (postbaccalaureate degree); approval of the Office of Professional Field Experiences.

EED 581 Diagnostic Practices in Mathematics. (3)

fall and spring

Specific skills in diagnosing and treating children's learning difficulties in mathematics. Includes practicum experiences, both on and off campus, in identifying strengths and weaknesses and initial remediation. Prerequisite: instructor approval.

EED 584 Internship. (1–12)

selected semesters

EED 598 Special Topics. (1–4)

selected semesters

Topics may include the following:

- Using Math Manipulatives/Elementary Schools
Fee.
- Using Math Manipulatives/Middle Schools
Fee.

EED 720 Language in Education. (3)

once a year

Sociolinguistic seminar on language issues in education, including language acquisition, classroom interaction, language attitudes, relation language, and class-gender ethnicity.

EED 730 Discourse Analysis in Education. (3)

spring in even years

Survey of issues in and approaches to discourse analysis in educational research, with focus on students' projects using discourse analysis. Lecture, discussion, workshop.

Omnibus Courses. For an explanation of courses offered but not specifically listed in this catalog, see "Omnibus Courses," page 50.

INDIAN EDUCATION (IED)

IED 410 History of American Indian Education. (3)

fall and spring

Philosophical and historical review of the development of American Indian education policies in both traditional and contemporary society. Credit is allowed for only IED 410 or 510.

IED 430 Issues in Language and Literacy of Indigenous Peoples. (3)

spring

Examines issues, policies, theoretical foundations, and practices of indigenous peoples and other language minority communities from a sociolinguistics and language reclamation perspective. Credit is allowed for only IED 430 or 530.

IED 444 The Role of Governments in Native Education Policy and Administration. (3)

fall

Examines the interrelationship of federal Indian policy, federal/state/tribal law, and tribal sovereignty as they have shaped American Indian education. Analyzes administrative practices and personnel, program and fiscal management, and resources as they reflect the historic and present influence of this triad of factors. Credit is allowed for only IED 444 or 544. Lecture, seminar.

IED 460 Yaqui History and Culture. (3)

fall

Yaqui history and culture ranging from precontact to the present. Larger themes of Yaqui identity, belief systems, family, traditions, community, resistance, dispersion, and survival. Credit is allowed for only IED 460 or 560.

IED 500 Administration and Management of Indian Education Programs. (3)

fall

Emphasizes educational leadership research and practice in the schooling of American Indian students. Examines effective practices.

IED 510 History of American Indian Education. (3)

fall and spring

Philosophical and historical review of the development of American Indian education policies in both traditional and contemporary society. Credit is allowed for only IED 510 or 410.

IED 530 Issues in Language and Literacy of Indigenous Peoples. (3)

spring

Examines issues, policies, theoretical foundations, and practices of indigenous peoples and other language minority communities from a sociolinguistics and language reclamation perspective. Credit is allowed for only IED 530 or 430.

IED 544 The Role of Governments in Native Education Policy and Administration. (3)

fall

Examines the interrelationship of federal Indian policy, federal/state/tribal law, and tribal sovereignty as they have shaped American Indian education. Analyzes administrative practices and personnel, program and fiscal management, and resources as they reflect the historic and present influence of this triad of factors. Credit is allowed for only IED 544 or 444. Lecture, seminar.

IED 560 Yaqui History and Culture. (3)

fall

Yaqui history and culture ranging from precontact to the present. Larger themes of Yaqui identity, belief systems, family, traditions, community, resistance, dispersion, and survival. Credit is allowed for only IED 560 or 460.

GRADUATE PROGRAMS AND COURSES

IED 594 Workshop in Indian Education. (6)

summer

Examines curriculum, pedagogy, community involvement, current issues, and research.

Omnibus Courses. For an explanation of courses offered but not specifically listed in this catalog, see "Omnibus Courses," page 50.

LIBRARY SCIENCE (LIS)

LIS 510 Computers and Technology in the School Library. (3)

fall

Library uses of technology and computers. Fundamental concepts and issues in library media centers.

LIS 533 Current Library Problems. (3)

fall

Critical analysis of current practices and problems in school librarianship.

LIS 540 Classification and Cataloging. (3)

fall

Descriptive cataloging and Dewey Decimal Classification of print and nonprint library materials.

LIS 561 Selection of Library Materials. (3)

fall

Principles and procedures used in the selection of materials for the school library.

LIS 563 Children's Literature. (3)

fall, spring, summer

Selects and uses children's literature and related nonprint media to support the elementary school curriculum. Cross-listed as RDG 563. Credit is allowed for only LIS 563 or RDG 563.

LIS 565 Literature for Hispanic Youth/Literatura para Jóvenes Hispanoparlantes. (3)

spring

Selects, analyzes, and utilizes literature for Hispanic and Spanish-speaking children and adolescents. Lecture, discussion. Cross-listed as BLE 565/RDG 565. Credit is allowed for only BLE 565 or LIS 565 or RDG 565.

LIS 571 Basic Reference Resources. (3)

spring

Provides reference service in the school library. Content and use of basic resources.

LIS 581 School Library Administration. (3)

spring

Administration of K–12 libraries and media centers.

LIS 584 School Library Internship. (1–6)

fall and spring

Omnibus Courses. For an explanation of courses offered but not specifically listed in this catalog, see "Omnibus Courses," page 50.

READING EDUCATION (RDG)

RDG 481 Reading Practicum. (3)

fall and spring

Applies concepts from RDG 414 in classroom settings. Students demonstrate teaching strategies under supervision. Required for Elementary Education candidates. Prerequisite: ITC admission.

RDG 505 Developmental Reading. (3)

fall, spring, summer

For classroom and special reading teachers. Specific professional skills in decoding, comprehension, and evaluation. Required for Special Reading Endorsement. Prerequisite: teaching certificate.

RDG 507 Content Area Literacy. (3)

fall, spring, summer

Theory, teaching strategies, and practical application concerning learning from text across subject matter disciplines.

RDG 522 Literacy/Biliteracy Development. (3)

fall

Acquaints teachers with first- and second-language literacy research, practice, and assessment in elementary school settings (Spanish-English emphasis). Lecture, discussion. Cross-listed as BLE 522. Credit is allowed for only BLE 522 or RDG 522.

RDG 525 Emergent Literacy. (3)

spring

Examines recent research on oral language and literacy development and effective strategies for teaching language and literacy in prekindergarten to grade 3. Lecture, discussion. Cross-listed as ECD 525. Credit is allowed for only ECD 525 or RDG 525.

RDG 530 Research Issues in Literacy. (3)

spring in odd years

For graduate students interested in research on major issues related to literacy instruction. Seminar activities include reviewing quantitative and qualitative methods and analyzing literacy research. Prerequisite: COE 501 or DCI 510 or EDP 502.

RDG 533 Literacy in Secondary BLE/ESL Settings. (3)

spring

Examines first- and second-language literacy research, practice, and assessment across content areas in secondary school settings. Lecture, discussion. Cross-listed as BLE 533. Credit is allowed for only BLE 533 or RDG 533.

RDG 544 Adolescent Literacy Programs for New Times. (3)

selected semesters

Theories, strategies, and issues in developing, implementing, and assessing approaches to literacy instruction for today's diverse adolescent students (grades 7–12). Prerequisite: RDG 507 or instructor approval.

RDG 550 Practicum Experiences in Elementary and Secondary Reading. (3)

spring and summer

Practicum experience utilizing assessment and instructional techniques for classroom settings. See RDG 557 for State of Arizona reading endorsement. Lab. Prerequisite: RDG 505 (or its equivalent).

RDG 556 Assessment and Procedures in Elementary and Secondary Reading. (3)

fall

Techniques for classroom and clinical reading assessment and instruction. Emphasizes continuous assessment. May be taken concurrently with RDG 557. Recommended for State of Arizona reading endorsement. Lecture, lab. Prerequisite: RDG 505.

RDG 557 Advanced Elementary and Secondary Reading Practicum. (3)

spring and summer

Advanced practicum experience utilizing specialized reading and other assessment and instruction techniques for classroom and clinic settings. Lab sections. Recommended for State of Arizona reading endorsement. May be taken concurrently with RDG 556. Lab. Prerequisites: RDG 505; instructor approval.

RDG 563 Children's Literature. (3)

fall, spring, summer

Selects and uses children's literature and related nonprint media to support the elementary school curriculum. Cross-listed as LIS 563. Credit is allowed for only LIS 563 or RDG 563.

RDG 565 Literature for Hispanic Youth/Literatura para Jóvenes Hispanoparlantes. (3)

spring

Selects, analyzes, and utilizes literature for Hispanic and Spanish-speaking children and adolescents. Lecture, discussion. Cross-listed as BLE 565/LIS 565. Credit is allowed for only BLE 565 or LIS 565 or RDG 565.

RDG 581 Literature-Based Reading Programs. (3)

fall, spring, summer

For classroom and special reading teachers. The role of literature in the acquisition and development of literacy. Specific suggestions for helping students learn to read and/or expand their reading ability with literature. Introduces literature studies. Prerequisite: teaching certificate.

RDG 582 Practicum: Literature Studies. (3)

spring

Practical application of literature study group principles in field sites or through on-campus simulations. Lecture, supervised practice. Prerequisite: RDG 581 or instructor approval.

RDG 596 Gender, Culture, and Literacies. (3)

spring

Influence of gender and culture on written, oral, and post-typographical texts. Seminar.

RDG 630 Research in Literacy. (3)*selected semesters*

For advanced graduate students interested in applied research problems, literature of literacy instruction, and major issues related to literacy research. Prerequisite: instructor approval.

Omnibus Courses. For an explanation of courses offered but not specifically listed in this catalog, see "Omnibus Courses," page 50.

SECONDARY EDUCATION (SED)**SED 400 Principles of Effective Instruction in Secondary Education. (3)***fall, spring, summer*

Examines different models of education. Develops and applies appropriate teaching practices for each model to secondary school classrooms. Lecture, discussion. Prerequisite: ITC admission.

SED 480 Special Methods of Teaching Social Studies. (3)*fall and spring*

Interdisciplinary approaches; production and collection of materials. Prerequisite: ITC admission.

SED 522 Secondary School Curriculum Development. (3)*fall, spring, summer*

Social processes, issues, principles, patterns, and procedures in curriculum development.

SED 533 Improving Instruction in Secondary Schools. (3)*fall, spring, summer*

Analyses of procedures, methods, techniques, and experiments in teaching in secondary schools.

SED 577 Issues and Trends in Secondary Education. (3)*selected semesters*

Analyses of lay and professional reports; problems and issues in American secondary education.

SED 578 Student Teaching in the Secondary Schools. (3–15)*fall and spring*

Practice of teaching. Relationship of theory and practice in teaching. Postbaccalaureate students only. Fee. Prerequisites: completion of approved postbaccalaureate program; minimum 2.50 GPA; approval of the Office of Professional Field Experiences.

SED 598 Special Topics. (1–4)*selected semesters*

Topics may include the following:

- Using Math Manipulatives/Middle Schools
Fee.

SED 711 Secondary Curriculum Development. (3)*spring and summer*

Theories and processes of developing curriculum; evaluation of research.

SED 722 Improvement of Instruction in the Secondary School. (3)*fall*

Evaluates the research; issues and theories related to the improvement of instruction.

Omnibus Courses. For an explanation of courses offered but not specifically listed in this catalog, see "Omnibus Courses," page 50.

Curriculum and Instruction**Interdisciplinary Doctoral Program**coe.asu.edu/programs

480/965-4602

ED 434

**Robert B. Rutherford Jr., Associate Director
of Research and Graduate Education****Art**

Professors: Erickson, Stokrocki, B. Young

Curriculum and Instruction

Professors: Baker, Barone, Bitter, Christie, Edelsky, Faltis, Flores, E. Garcia, Guzzetti, Hudelson, Ovando, Rutherford, Swadener, Tobin, Zucker

Associate Professors: Anijar, Arias, Blumenfeld-Jones, Cohn, Di Gangi, Gomez, McCoy, Middleton, Surbeck

Assistant Professors: Clark, Lamorey, MacSwan, J. Young

Educational Leadership and Policy Studies

Regents' Professor: Berliner

Associate Professor: Margolis

English

Professors: Crowley, Edelsky, Lester, Miller, Nilsen, Roen

Associate Professors: Goggin, Nelson

Exercise and Wellness (ASU East)

Professors: Burkett, Stone

Associate Professors: Phillips, Swan

Assistant Professor: Tudor-Locke

Human Communication

Professor: Arnold

Kinesiology

Professor: Darst

Life Sciences

Professor: Lawson

Mathematics and Statistics

Associate Professor: Carlson

Assistant Professor: Zandieh

Nutrition (ASU East)Professors: Hampl, Vaughan

The Interdisciplinary Committee on Curriculum and Instruction offers an interdisciplinary graduate program leading to the Ph.D. degree in Curriculum and Instruction. The interdisciplinary committee sets guidelines and supervises programs of study.

Areas of concentration are available in

1. art education;
2. curriculum studies;

GRADUATE PROGRAMS AND COURSES

3. early childhood education;
4. elementary education;
5. English education;
6. exercise and wellness education;
7. language and literacy;
8. mathematics education;
9. physical education;
10. science education; and
11. special education.

One of the unique features of this interdisciplinary program is that, because it utilizes faculty research and teaching interests from a number of academic units, students may work in concert with their program committee to tailor a course of study to fit individual needs and goals.

The interdisciplinary Ph.D. committee mentors set guidelines and supervise programs of study, while an executive committee, appointed by the dean of the College of Education and the dean of graduate studies, has primary responsibility for the operation of the program. It is composed of faculty representing the various concentrations.

DOCTOR OF PHILOSOPHY

The Ph.D. degree in Curriculum and Instruction is an individualized interdisciplinary degree that integrates graduate courses from a variety of academic units. This course work provides a substantive knowledge base in the concentration area and a sound foundation for research leading to a dissertation.

See "Doctor of Philosophy," page 96, for general requirements.

Admission. In addition to meeting minimum Graduate College admission requirements, each applicant must provide the following:

1. a letter of career goals and statement of reasons for seeking the interdisciplinary Ph.D. in Curriculum and Instruction,
2. Graduate Record Examination (GRE) verbal and quantitative test scores,
3. a sample of written work, and
4. three academic letters of recommendation.

One year of full-time teaching experience at the appropriate level, or its equivalent, is strongly recommended. In the absence of prior teaching experience, a teaching internship is required but may not be counted toward the Ph.D. degree.

Admission decisions are based upon the compatibility of the applicant's career goals with the purpose of the degree program, previous academic training and performance, GRE scores, letters of recommendation, and the availability of a potential mentor in the candidate's concentration area. It should be noted that, because of enrollment limits, applicants who meet minimum requirements are not automatically admitted.

Program Committee. The student's program committee, consisting of a chair and at least two other members, oversees the preparation of the initial program of study and the preparation and evaluation of the comprehensive examina-

tion. Though the program committee may consist of only three members for early advising, it must have *at least five members* for the administration and evaluation of the comprehensive examination, three of whom must be members of the interdisciplinary committee and two of whom must be experts in the student's area of concentration. At least one member of the program committee must be a faculty member of the Division of Curriculum and Instruction. The committee must be approved by the dean of graduate studies.

The program committee and the student must decide on the area of concentration and cognate area to be included in the student's comprehensive examination. They also must develop a program of study to establish a professional knowledge base and methods of inquiry and analytical tools for research.

Dissertation Committee. After passing the comprehensive examination, a dissertation committee is formed, upon the approval of the dean of graduate studies. The basic functions of the dissertation committee are as follows:

1. overseeing the development and approval of a dissertation proposal,
2. providing guidance while the candidate conducts the dissertation study/analysis,
3. reviewing the dissertation manuscript, and
4. conducting an oral defense of the dissertation.

Members of the program committee may also serve as members of the dissertation committee; however, the committees may have different memberships. At least one member of the dissertation committee must be a faculty member of the Division of Curriculum and Instruction. The dissertation committee chair must be a faculty member designated eligible to serve in this capacity by the interdisciplinary committee and the dean of graduate studies.

Program of Study. The program requires at least 93 semester hours, or the equivalent of four academic years of full-time study, beyond the bachelor's degree. Students with a master's degree directly related to the anticipated course of study must complete a minimum of 54 semester hours beyond the master's degree. At least 30 semester hours in the approved program of study, exclusive of research and dissertation, must be taken at ASU. Each candidate must also register for a minimum of 24 semester hours of research and dissertation credit, with the dissertation directed by a dissertation chair approved by the interdisciplinary committee and the dean of graduate studies. The program of study is divided into four general areas:

1. Ph.D. core course requirements;
2. professional focus;
3. cognate study; and
4. independent research and dissertation.

Core Course Requirements. All doctoral students are required to complete two designated core courses: DCI 702 Interdisciplinary Research Seminar and DCI 701 Curriculum Theory and Practice.

Professional Focus. With the advice and approval of the student's program committee, a student must select a sequence

of courses and experiences designed to focus subsequent efforts on a particular aspect of curriculum and instruction, culminating in a dissertation. The professional focus is divided into three areas:

1. methods of inquiry and analytical tools associated with empirical study of curriculum and instruction;
2. a substantive knowledge base in the area of concentration; and
3. internships in research and college teaching.

Semester hours counted under one category may not be counted under another. Courses (42 semester hours) are drawn from program courses in the student's area of concentration.

Cognate Study. Students are expected to choose interrelated courses (12 semester hours minimum) outside their declared area of concentration that have a clear link to their dissertation efforts. Cognate studies can be drawn from a range of offerings, both within and outside the College of Education.

Foreign Language Requirements. None.

Annual Report for Ph.D. Candidates. At the end of each school year (before the last day of final exams), the student's Ph.D. mentor prepares a report to be reviewed by the director of the interdisciplinary Ph.D. degree program. Copies of the report are distributed to the members of the student's program or dissertation committee. The report from the mentor, which is accompanied by the student's transcript and an up-to-date *curriculum vitae*, includes the following:

1. a statement concerning the status of the student's program of study (with a copy);
2. a statement of the status of preparation toward the student's comprehensive examination (including a projected date for completion);
3. a statement about the student's performance in course work; and
4. a statement about the student's accomplishments during the academic year (and summer, if appropriate), including research activity, writings, presentations, and professional accomplishments.

Comprehensive Examination. Upon completion of course work in the Ph.D. program of study and before admission to candidacy and the start of the dissertation research, the student completes an examination in the areas of concentration, cognate study, and methods of inquiry and analytical tools. The examination is designed to test the student's accumulation of interdisciplinary knowledge and ability to communicate across disciplines. The comprehensive examination is developed and administered by the student's five-member program committee.

Dissertation Proposal. The proposal prospectus typically constitutes a draft of the first three chapters of the dissertation, but may vary with the dissertation committee's approval. Following approval of the proposal by the dissertation committee chair, a proposal meeting is scheduled. Approval of the proposal at that meeting indicates that the faculty agree that the rationale, review of the literature, method, and proposed analyses are appropriate and that the study may proceed as planned. If problems are identified in the proposal meeting, the dissertation committee may meet again to hear a revised proposal or arrange a more relevant way to reexamine the proposal.

Research and Dissertation. Twenty-four semester hours of research and dissertation credit are required. Twelve dissertation credits must be reserved for postcandidacy registration. The dissertation is designed to be the student's culminating experience. The dissertation must consist of a fully documented written study demonstrating a high level of expertise in research and scholarship in the student's area of concentration. The dissertation should make an original contribution to inquiry in the area of curriculum and instruction and be worthy of publication by an established press as a book or monograph or as one or more articles in a refereed, scholarly journal. The dissertation should not only demonstrate that the student is able to conduct quality research, but also should be conceived and carried out in such a way that it should make a contribution to advancing scholarship in the field of curriculum and instruction.

Final Examinations. The final oral examination in defense of the dissertation is scheduled and conducted by the student's dissertation committee. A candidate must pass the final examination within five years after completing the comprehensive examination.

Master's in Passing. A master's in passing is available for the following concentrations: early childhood education, elementary education, language and literacy, mathematics education, science education, and special education.

RESEARCH ACTIVITY

Current faculty research activities include the E-Learning network: learning anytime anywhere; family-centered early identification of children with learning disabilities and behavior disorders; bilingual/English as a second language/special education; Arizona behavior initiative: creating school environments that support high academic standards for all students; relationship-based practice in early intervention settings; explaining low achievement in limited English proficient students; and extending and sustaining use of reforms in mathematics classrooms.