
Chemistry

James P. Allen
Assistant Chair for Graduate Studies
 (PS D102A) 480/965-4664
 chmgrad@asu.edu
 www.asu.edu/clas/chemistry

REGENTS' PROFESSORS

ANGELL, BUSECK, C. MOORE,
 O'KEEFE, PETTIT

PROFESSORS

ALLEN, BIEBER, BIRK, BLANKENSHIP, FUCHS,
 GLAUNSINGER, GUST, HOLLOWAY, LOHR, McMILLAN,
 A. MOORE, T. MOORE, MUNK, PETUSKEY, ROSE, SKIBO,
 STEIMLE, WILLIAMS, WOODBURY

ASSOCIATE PROFESSORS

KOUVETAKIS, WOLF

ASSISTANT PROFESSORS

BOOKSH, CAUDLE, FRANCISCO,
 GOULD, HAYES, RICHERT

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 263), and the interdisciplinary programs, leading to the Ph.D. degrees with majors in Exercise Science (see "Master of Physical Education," page 270) and the Science and Engineering of Materials (see "Science and Engineering of Materials," page 290).

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 101, 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 104, for general requirements.

Program of Study. A minimum of 84 semester hours, including dissertation, is required. Approximately 20–30 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 105.)

Final Examinations. 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.

RESEARCH ACTIVITY

Current research in the department is reflected in the following list of subjects: chemical bonding; atomic spectroscopy; transition elements; organometallic chemistry; meteorite chemistry; electrical properties of titanium oxides; X-ray and neutron crystallography; X-ray crystallography of membrane proteins; photobiology; electronic structure and mechanisms involved in pigment systems; artificial photosynthesis; bacterial photosynthesis; chemical applications of nuclear magnetic resonance spectroscopy; organic mass spectrometry including field ionization kinetics; biochemical pharmacology; structure of biopolymers; metalloproteins; molecular biology; site-directed mutagenesis; quantitative analysis with electron beam instruments; enzymes of purine metabolism; toxic proteins from Mojave rattlesnake venom; purine and pyrimidine chemistry; design of potential antitumor agents; design and synthesis of imaging agents of malignant tissues; redox chemistry of quinones;

rate processes and molecular spectroscopy; nature and origin of organic compounds in carbonaceous meteorites; computer-assisted structure elucidation; cycloaddition and cycloreversion reactions; magnetic; chemisorption; and catalytic behavior of small metallic particles; structure and properties of metal-ammonia systems; solid-state geochemistry; nucleic acid chemistry and electron microscopy; separations and chromatographic detectors; electron microprobe analysis of air-pollutants; metal complexes of macrocyclic chelating agents; structure analysis of metal complexes having a high coordination number; molecular orbital calculations; infrared and Raman spectroscopy; ceramics; laser spectroscopy; ultrafast kinetics; microwave spectroscopy.

In addition, interdisciplinary research is actively pursued in several areas, e.g., biochemistry, geochemistry, solid-state science, and materials science. Magnetic and magnetic resonance studies involve faculty and students from the Departments of Physics and Astronomy and Chemistry and Biochemistry in a well-equipped magnetism facility. Approximately 35 faculty members from the Departments of Chemistry and Biochemistry, Physics and Astronomy, Geology and the College of Engineering and Applied Sciences are associated with the Center for Solid-State Science. The center includes a number of specialized facilities such as electron microscopy and crystal-growing laboratories. Eleven faculty members from the Departments of Chemistry and Biochemistry and Plant Biology are associated with the Center for the Study of Early Events in Photosynthesis. This center has unique instrumentation for studying the earliest energy storing reactions of photosynthesis. The Center for Meteorite Studies and the Cancer Research Institute also foster interdisciplinary research efforts. Faculty in the Department of Chemistry and Biochemistry also participate in collaborative programs in the science and engineering of materials and in molecular and cellular biology.

BIOCHEMISTRY (BCH)

BCH 461 General Biochemistry. (3) F

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

BCH 462 General Biochemistry. (3) S

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

BCH 463 Biophysical Chemistry. (3) S

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

BCH 467 Analytical Biochemistry Laboratory. (3) S

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

BCH 563 Biophysical Chemistry. (3) N

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) S

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 Graduate Courses. See page 57 for omnibus graduate courses that may be offered.

CHEMISTRY (CHM)

CHM 424 Separation Science. (3) N

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. Prerequisite: CHM 318 or 332 or 345 or instructor approval.

CHM 431 Qualitative Organic Analysis. (3) S

Systematic identification of organic compounds. 1 hour lecture, 6 hours lab. Prerequisites: CHM 118 (or 326) and 320 (or 336) or instructor approval.

CHM 452 Inorganic Chemistry Laboratory. (1–2) S

Preparation and characterization of typical inorganic substances, emphasizing methods and techniques. 1 conference, 5 hours lab. Prerequisite: instructor approval. *General Studies: L (if credit also earned in CHM 348 and 349).*

CHM 453 Inorganic Chemistry. (3) S

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

CHM 460 Biological Chemistry. (3) S

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) F

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) S

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

CHM 481 Geochemistry. (3) F

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 485 Meteorites and Cosmochemistry. (3) N

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) N

(a) Chemistry of Global Climate Change. (3)

CHM 501 Current Topics in Chemistry. (1) F, S

May be repeated for credit. Prerequisite: instructor approval.

CHM 521 Computer Enhanced Analytical Chemistry. (3) N

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) A

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

CHM 525 Spectrochemical Methods of Analysis. (4) N

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

CHM 526 X-ray Methods of Analysis. (4) N

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 Electrical Methods of Chemical Analysis. (4) N

Theoretical and practical considerations of polarographic, potentiometric, amperometric techniques, including modern electrochemical methods. 2 hours lecture, 6 hours lab. Prerequisite: CHM 346.

CHM 531 Advanced Organic Chemistry I. (3) F

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. (2) S

Continuation of CHM 531. Prerequisite: CHM 531.

CHM 537 Organic Reactions. (3) S
Important synthetic reactions of organic chemistry emphasizing recently discovered reactions of preparative value. Prerequisite: CHM 531.

CHM 541 Advanced Thermodynamics. (3) F
Equilibrium thermodynamics, chemical reactions, and phase equilibria. Introduction to statistical thermodynamics, critical phenomena, and kinetics. Prerequisite: CHM 346.

CHM 545 Quantum Chemistry I. (3) F
Basic quantum theory, chemical bonding, and molecular structure. Prerequisite: CHM 346.

CHM 546 Quantum Chemistry II. (3) S
Quantum theory of rate processes. Principles of spectroscopy and nonlinear optics. Prerequisite: CHM 545.

CHM 548 Chemical Kinetics. (2) N
Kinetic theory and rate processes. Prerequisite: CHM 545.

CHM 553 Advanced Inorganic Chemistry. (3) S
Principles of modern inorganic chemistry and their applications over the entire periodic system. Prerequisites: CHM 346 and 453 or equivalents.

CHM 556 Topics in Inorganic Chemistry. (3) N
May be repeated for credit. Prerequisites: CHM 553; instructor approval.

CHM 579 Topics in Solid-State Chemistry. (3) N
May be repeated for credit. Prerequisite: instructor approval.

CHM 582 Topics in Geochemistry and Cosmochemistry. (3) N
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) N
Natural reactions at high temperatures and pressures; silicate, sulfide, and oxide equilibria. Cross-listed as GLG 583. Credit is allowed for only CHM 583 or GLG 583.

CHM 593 Applied Project. (1–12) N
(a) Glass Blowing

Omnibus Graduate Courses. See page 57 for omnibus graduate courses that may be offered.

Civil Engineering

Sandra L. Houston
Chair
(ECG 252) 480/965-3589
cee@asu.edu
www.eas.asu.edu/~civil

PROFESSORS

S. HOUSTON, W. HOUSTON, MAMLOUK,
MAYS, RAJAN, SINGHAL, WITCZAK

ASSOCIATE PROFESSORS

ABBASZADEGAN, DUFFY, FAFITIS, FOX,
HINKS, JOHNSON, MOBASHER

ASSISTANT PROFESSORS

MUCCINO, OWUSU-ANTWI, WESTERHOFF, ZHU

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

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 101, for general requirements.

MASTER OF SCIENCE IN ENGINEERING

See “Master of Science in Engineering,” page 191.

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 104, 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 comprehensive 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 Examinations. 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. The faculty pursue research topics related to the advancement of knowledge in civil and environmental engineering.

Experimental and theoretical investigations by civil and environmental engineering faculty and students are carried out in the specialized areas of environmental engineering, geotechnical/geoenvironmental engineering, structures/materials engineering, transportation/materials engineering, and water resources engineering.

Areas of Study

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

Environmental Engineering. This area of study includes the quality of air, water, and land resources; transport, use, and disposal of hazardous wastes; water and wastewater treatment; and water reuse.

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 planning, design, and operation and (2) pavements and materials. Transportation planning, design, and operation covers urban transport planning, geometric design of facilities, traffic operations, evaluation of highway capacity and safety, and intelligent vehicle/highway systems. Pavements and materials focus 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 412 Pavement Analysis and Design. (3) F
Design of flexible and rigid pavements for highways and airports. Surface, base, and subgrade courses. Cost analysis and pavement selection. Prerequisites: CEE 351; ECE 351.

CEE 423 Structural Design. (3) F
Analysis and design of reinforced concrete steel, masonry, and timber structures. Lecture, lab. Prerequisite: CEE 323. Pre- or corequisite: CEE 322.

CEE 432 Matrix and Computer Applications in Structural Engineering. (3) S
Matrix and computer applications to structural engineering and structural mechanics. Stiffness and flexibility methods, finite elements, and differences. Prerequisite: CEE 321.

CEE 440 Engineering Hydrology. (3) F
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) S
Application of the principles of hydraulics and hydrology to the engineering of water resources projects; design and operation of water resources systems; water quality. Prerequisite: CEE 341.

CEE 452 Foundations. (3) F
Applications of soil mechanics to foundation systems, bearing capacity, lateral earth pressure, and slope stability. Prerequisite: CEE 351.

CEE 466 Sanitary Systems Design. (3) F
Capacity, planning and design of water supply, domestic and storm drainage, and solid waste systems. Prerequisite: CEE 361.

CEE 471 Intelligent Transportation Systems. (3) N
Application of advanced technology to the vehicle and the roadway to solve traffic congestion, safety, and air quality problems. Prerequisite: CEE 372 or instructor approval.

CEE 475 Highway Geometric Design. (3) S
Design of the visible elements of the roadway. Fundamental design controls with application to rural roads, at-grade intersections, freeways, and interchanges. Lecture, recitation. Prerequisite: CEE 372.

CEE 486 Integrated Civil Engineering Design. (3) F, S
Students are required to complete a civil engineering design in a simulated practicing engineering environment. Lecture, team learning. Limited to undergraduates in their final semester. Prerequisites: CEE 321, 341, 351, 361, 372. *General Studies: L.*

CEE 512 Pavement Performance and Management. (3) S
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) F
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. Prerequisite: ECE 351.

CEE 515 Properties of Concrete. (3) S
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. Prerequisite: ECE 350 or 351.

CEE 521 Stress Analysis. (3) F
Advanced topics in the analytical determination of stress and strain. Prerequisite: CEE 321.

CEE 524 Advanced Steel Structures. (3) F
Strength properties of steel and their effects on structural behavior. Elastic design of steel structures. Plastic analysis and design of beams, frames, and bents. Plastic deflections. Plastic design requirements. Multistory buildings. Prerequisite: CEE 322.

CEE 526 Finite Element Methods in Civil Engineering. (3) F
Finite element formulation for solutions of structural, geotechnical, and hydraulic problems. Prerequisite: CEE 432.

CEE 527 Advanced Concrete Structures. (3) N
Ultimate strength design. Combined shear and torsion. Serviceability. Plastic analysis. Special systems. Prerequisite: CEE 323.

CEE 530 Prestressed Concrete. (3) N
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 323.

CEE 533 Structural Optimization. (3) N
Linear and nonlinear programming. Problem formulation. Constrained and unconstrained optimization. Sensitivity analysis. Approximate techniques. FEM-based optimal design of mechanical and aerospace structures. Cross-listed as MAE 521. Credit is allowed for only CEE 533 or MAE 521. Prerequisite: instructor approval.

CEE 536 Structural Dynamics. (3) N
Structures and structural members subjected to dynamic loadings, response spectra theory applications to bridges and power plants, investigations of the responses of multidegree of freedom structures, and matrix and numerical methods of analysis. Lecture, recitation. Prerequisites: CEE 321; instructor approval.

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

Theory and application of quantitative planning methodologies for the design and operation of water resources systems; class projects using a computer; case studies. Pre- or corequisite: instructor approval.

CEE 546 Free Surface Hydraulics. (3) S

Derivation of 1-dimensional 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) N

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) N

Introduction to 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) N

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

CEE 551 Advanced Geotechnical Testing. (3) N

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. Prerequisite: CEE 351.

CEE 552 Geological Engineering. (3) N

Geological investigations for engineering purposes, case histories, geologic structure, weathering, remote sensing, geophysics, and air photo interpretation for engineering site locations. Lecture, field trips. Prerequisite: CEE 351.

CEE 553 Advanced Soil Mechanics. (3) N

Application of 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) N

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) N

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

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

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) N

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) F

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

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

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

CEE 562 Environmental Biochemistry and Waste Treatment. (3) S

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

CEE 563 Environmental Chemistry Laboratory. (3) F

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

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

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) N

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

CEE 573 Traffic Engineering. (3) N

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) N

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

CEE 575 Traffic Flow Theory and Safety Analysis. (3) N

Traffic flow theory; distributions, queuing, delay models, and car-following. Highway safety; accident records systems, accident analysis, identifying problem locations, and accident countermeasures. Prerequisite: CEE 573 or 574.

CEE 577 Urban Transportation Planning. (3) N

Application of land use parameters traffic generation theory, traffic distribution and assignment models, transit analysis, and economic factors to the solution of the urban transportation problem. Prerequisite: CEE 372.

CEE 580 Practicum. (1–12) N**CEE 590 Reading and Conference.** (1–12) N**CEE 592 Research.** (1–12) N**CEE 599 Thesis.** (1–12) N**CEE 792 Research.** (1–15) N**CEE 799 Dissertation.** (1–15) N

Students enrolled in CEE 580, 590, 592, 599, 792, and 799 are required to attend graduate student seminars at the times shown in the Schedule of Classes. Each semester, every graduate student enrolled for more than eight semester hours is to enroll for at least one semester hour of CEE 592, 599, 792, or 799.

Omnibus Graduate Courses. See page 57 for omnibus graduate courses that may be offered.

Communication

Master's Program

Kristin B. Valentine

Director of Graduate Studies

(STAUF A412) 480/965-5096

Kristin.Valentine@asu.edu

www.asu.edu/copp/communication/academic/masters

PROFESSORS

ARNOLD, BANTZ, BROOME, CANARY, JAIN, MARTIN, McPHEE, PETRONIO, VALENTINE

ASSOCIATE PROFESSORS

ALBERTS, BULEY, CARLSON, COREY, CORMAN, CRAWFORD, DAVEY, GUERRERO, MAYER, NAKAYAMA, TROST

ASSISTANT PROFESSORS

DAVIS, TRETHERWEY

INSTRUCTIONAL PROFESSIONAL

OLSON

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 rhetoric.

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) 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. an optional writing sample; and
6. all applicants whose native language is not English must submit scores from the Test of English as a Foreign Language (TOEFL). Minimum scores are 550 on the paper and pencil version of this test or 213 on the computer version of this test. The Hugh Downs School of Human Communication also requires a minimum score of 230 on the Test of Spoken English.

A completed application for admission and two transcripts of all undergraduate and graduate work must be submitted to the Graduate Admissions Office. See "Admission to the Graduate College," page 92, for Graduate College general requirements. All application materials must be received by February 1.

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";
2. COM 504 Theories and Models in Communication with a minimum grade of "B";
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";
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 such deficiencies, 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 as appropriate. Descriptions of current program options and requirements are available from the Hugh Downs School of Human Communication, STAUF A412.

RESEARCH ACTIVITY

Faculty members in the Hugh Downs School of Human Communication are dedicated to conducting and reporting quality research. The Communication Research Consortium assists faculty and graduate students in planning and conducting independent and interdisciplinary research. Typical research topics studied by members of the faculty include the following: communication and culture, messages as organizational products, privacy rules in interpersonal communication, the role of attitude and cultural similarity in the development of interpersonal relationships, the role of communication in intimate relationships, the performance of culture, the communication of oral traditions, the development of critical theory, the development of communication networks, intercultural communication competence, communication in small groups, communication with aging populations, discourse in organizational settings, and the influence of rhetorical discourse upon social issues.

COMMUNICATION (COM)

COM 400 CIP: Communication in Professions. (3) F, S, SS
Specialized study of communication processes in professional and organizational settings. May be repeated for credit.

- (a) Asian Pacific American Arts and Cultures. (3) F, S
Exploration of Asian Pacific American cultural expression in art, literature, film, theatre, dance, and music. Lecture, discussion. Cross-listed as APA 310. Credit is allowed for only APA 310 or COM 400.
- (b) Asian Pacific Americans and Media. (3) F
Analysis of social construction of Asian Pacific American media images and resistance to those images in various historical contexts. Lecture, discussion. Cross-listed as APA 340. Credit is allowed for only APA 340 or COM 400.

Prerequisites: COM 100 and 225 or COM 259; 2.25 GPA.

COM 404 Research Apprenticeship. (3) F, S
Direct research experience on faculty projects. Student/faculty match based on interests. Lecture, apprenticeship. Prerequisites: COM 308 (or instructor approval); application required.

COM 407 Advanced Critical Methods in Communication. (3) S
Examination of critical approaches relevant to communication, including textuality, social theory, cultural studies, and ethnography. Lecture, discussion. Prerequisite: COM 308.

COM 408 Quantitative Research Methods in Communication. (3) F, S
Advanced designs, measurement techniques, and methods of data analysis of communication research. Prerequisites: COM 308 and a generic statistics course (EDP 454 or POS 401 or PSY 230 or QBA 221 or SOC 390 or STP 226) or instructor approval.

COM 410 Interpersonal Communication Theory and Research. (3) F, S, SS
Survey and analysis of major research topics, paradigms, and theories dealing with message exchanges between and among social peers. Prerequisites: COM 110 (or 310) and 308 or instructor approval. *General Studies: SB.*

COM 411 Communication in the Family. (3) A
A 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) and 207 or instructor approval. *General Studies: SB.*

COM 414 Crisis Communication. (3) N
Role of communication in crisis development and intervention.

COM 417 Communication and Aging. (3) N

Critical study of changes in human communicative patterns through the later adult years, with attention on intergenerational relationships and self-concept functions.

COM 421 Rhetoric of Social Issues. (3) F, S

Critical rhetorical study of significant speakers and speeches on social issues of the past and present. Prerequisites: COM 308 and 321 or instructor approval. *General Studies: HU.*

COM 422 Advanced Argumentation. (3) N

Advanced study of argumentation theories and research as applied to public forum, adversary, scholarly, and legal settings. Prerequisite: COM 222 or instructor approval.

COM 426 Political Communication. (3) F

Theories and criticism of political communication; including campaigns, mass persuasion, propaganda, and speeches. Emphasis on rhetorical approaches. *General Studies: SB.*

COM 430 Leadership in Group Communication. (3) N

Theory and process of leadership in group communication, emphasizing philosophical foundations, contemporary research, and applications to group situations. Prerequisite: COM 230 or instructor approval.

COM 441 Performance Studies. (3) F, S, SS

Theory, practice, and criticism of texts in performance. Emphasis on the interaction between performer, text, audience, and context. Prerequisites: COM 241 and 308 or instructor approval. *General Studies: HU.*

COM 445 Narrative Performance. (3) N

Theory and practice of performing narrative texts (e.g., prose fiction, oral histories, diaries, essays, letters). Includes scripting, directing, and the rhetorical analysis of story telling. Prerequisite: COM 241 or instructor approval. *General Studies: HU.*

COM 446 Interpretation of Literature Written by Women. (3) N

Students explore, through performance and critical writing, literature written by women. *General Studies: HU, C.*

COM 450 Theory and Research in Organizational Communication. (3) F, S, SS

Critical review and analysis of the dominant theories of organizational communication and their corollary research strategies. Prerequisites: COM 250 and 308 or instructor approval. *General Studies: SB.*

COM 453 Communication Training and Development. (3) A

Examination of the procedures and types of communication training and development in business, industry, and government. Prerequisite: COM 250 or instructor approval.

COM 463 Intercultural Communication Theory and Research. (3) F, S, SS

Survey and analysis of 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 and 308 or instructor approval. *General Studies: SB, G.*

COM 465 Intercultural Communication Workshop. (3) N

Experientially based study of communication between members of different cultures designed to help students improve their intercultural communication skills. Prerequisite: instructor approval.

COM 480 Methods of Teaching Communication. (3) N

Analysis, organization, and presentation of textual and other classroom materials. Prerequisite: instructor approval.

COM 494 Special Topics. (1–3) F, S, SS**COM 501 Research Methods in Communication.** (3) F

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) F

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) F

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

COM 509 Qualitative Research Methods in Communication. (3) S

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

COM 510 Interpersonal Communication Theory and Research. (3) A

Contemporary theories and research in interpersonal communication. Prerequisites: COM 501 and 504 or instructor approval.

COM 512 Death, Society, and Human Experience. (3) N

Examines dying, death, bereavement, and suicide from both individual and sociocultural perspectives in terms of options for communication and action in death-related situations. Prerequisite: instructor approval.

COM 521 Rhetorical Criticism of Public Discourse. (3) N

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

COM 584 Communication Internship. (1–12) F, S, SS**COM 596 Pro-Seminar in Communication.** (0) F

Discussion of research projects with the faculty. Prerequisite: admission to the graduate program.

COM 604 Theory Construction in Communication. (3) F

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) S

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) S

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

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

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 680 Practicum: Research in Communication. (3) S

Guided practice in the conduct of communication research. Topic identification; procedures, formats, and ethics of publishing. Prerequisite: COM 604.

COM 691 Seminar. (3) F, S, SS

Seminar topics such as the following may be offered:

- (a) Current Organizational Approaches to Communication
- (b) Examination of Privacy and Disclosure
- (c) Intercultural Aspects of Communication
- (d) Interpersonal and Relational Communication
- (e) Research in Performance Studies
- (f) Rhetorical Issues
- (g) Social Influence

Lecture, discussion. Prerequisite: instructor approval.

COM 792 Research. (1–12) N**COM 799 Dissertation.** (1–15) N

Omnibus Graduate Courses. See page 57 for omnibus graduate courses that may be offered.

Communication

Interdisciplinary Doctoral Program

Robert D. McPhee

Director

(STAUF A412) 480/965-5096

marion.yakerson@asu.edu

www.asu.edu/copp/communication/academic/doctorate

Communication

Professors: Arnold, Bantz, Broome, Canary, Jain, Martin, McPhee, Petronio, Valentine;

Associate Professors: Alberts, Buley, Carlson, Corey, Corman, Davey, Guerrero, Mayer, Nakayama, Trost;

Assistant Professors: Davis, Trethewey

Educational Leadership and Policy Studies

Assistant Professor: Margolis

English

Professor: Roen;

Associate Professor: Miller

Family Resources and Human Development

Professors: Christopher, Fabes

Industrial Management Systems Engineering

Professor: Dooley

Journalism and Telecommunications

Professor: Godfrey

Justice Studies

Regents' Professor: Altheide;

Professors: Goldberg, Johnson, Romero

Recreation Management and Tourism

Professor: Allison

Sociology

Professor: Nagasawa

Supply Chain Management

Professors: Metcalf, Smeltzer

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 designed to prepare scholars 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 104, for general requirements.

Admission Requirements. Admission to the program is competitive. Applications are considered once a year for fall admission. 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 the-

sis, 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) 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 and a minimum score of 230 on the Test of Spoken English 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 not processed.

Supervisory/Dissertation Committee. This committee consists of a chair and at least two other members appointed by the dean of the Graduate College 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. Contact the director for an up-to-date list of program faculty and their areas of interest.

Communicative Development. This area of concentration includes the study of communicative behaviors and functions as they evolve and change over time. Students in this area study the role of communication in interpersonal processes, performance studies, and rhetoric.

Intercultural Communication. The theoretical relationship between culture and communication is the focus of this area of concentration. Students in this area study the effects of cultural/ethnic differences and similarities on a wide range of communication processes. Students may also explore the communication of culture and ethnicity.

Interpersonal Communication. This area of concentration examines the role of communication in the development, maintenance, and termination of interpersonal relationships. Students in this area study relationship development, the role of emotions in communication and relationships, social influence, conflict, and marital and family communication, among other topics.

Organizational Communication. This area of concentration examines the role of communicative processes and systems in public and private organizations with an emphasis on the interaction between organizational participants and organizational structures, practices, informational channels, networks, and message forms.

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.

Program of Study. If the student has completed an appropriate master's degree, the Ph.D. requires a minimum of 60 hours beyond the master's degree. Course work for a typical program of study is distributed as follows: required core courses (19 semester hours), area of concentration (27 semester hours), dissertation (COM 799) and research (COM 792) (24 semester hours) for a total of 60 hours (minimum). Four interdisciplinary theory and methodology courses, taken in sequence, are required of all students entering the program. The required theory course is COM 604 Theory Construction in Communication. Students are also required to take COM 792 Practicum: Research in Communication. 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.

In addition to the three-hour section of COM 792 described above, students are required to complete at least three additional hours of 792. Products of at least one 792 course are presented in a public colloquium.

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 84 hours of interdisciplinary graduate work is required for the program, with the same 60-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 Examinations. 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 undertake 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 the student 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 six hours of research (COM 792) may be taken before admission to candidacy. Students must enroll for 12 hours of research (COM 792)/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 Examinations. An oral examination in defense of the dissertation, conducted by the dissertation committee, is required.

RESEARCH ACTIVITY

Members of the Committee of Faculty are engaged in a variety of research activities. Among others, the following represent research interests of the faculty approved to direct dissertations: the role of communication in creating organizational cultures, the process of social influence, explaining communication in interpersonal and intergroup encounters, the development of interpersonal relationships, the role of subjective culture in the attribution of meaning, the development of communication competencies, privacy regulation, cross-cultural variations in interpersonal communication, identity-validation in intergroup encounters, communication networks, the impact of newer information technologies in organizations, the role of communication in response to disasters, and communication in multinational corporations.

Communication Disorders

David Ingram
Chair
 480/965-2374
 shsgrad@asu.edu
 www.asu.edu/clas/shs

PROFESSORS

BACON, CASE, DORMAN, D. INGRAM,
 LAPOINTE, WILCOX

ASSOCIATE PROFESSORS

LISS, SINEX

ASSISTANT PROFESSORS

AZUMA, SHARMA

CLINICAL PROFESSOR

MATHY

CLINICAL ASSOCIATE PROFESSORS

BACON, BROWN, MINTZ, REMSON

CLINICAL ASSISTANT PROFESSORS

COOK, K. INGRAM, 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, and students may study either speech-language pathology or audiology. The program is accredited by the Council on Academic Accreditation of the American Speech-Language-Hearing Association.

Admission Requirements. Students applying for admission to this program should have their undergraduate transcripts mailed to the Graduate Admissions Office. In addition, candidates should have their Graduate Record Examination scores, a statement of professional and academic goals not to exceed 200 words, and three letters of recommendation sent to the Department of Speech and Hearing Science. All materials must be received in the department 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 a minimum of 30 or 33 semester hours of graduate course work, exclusive of credit for practicum, 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 375 clock hours of supervised clinical practicum experience, of which a minimum of 250 clock hours must be obtained at the graduate level.

Thesis Option. Students wishing to pursue the thesis option will complete 30 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 will complete 33 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 National Teacher Examination in speech pathology, or the National Teacher Examination in audiology, administered by Educational Testing Service and available at ASU through the University Testing Service, 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 National Teacher Examination in speech pathology, or the National Teacher Examination in audiology, administered as described above, 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 faculty and students in the Department of Speech and Hearing Science maintain active research programs. Students are encouraged to conduct research during their entire graduate program.

The department maintains the equipment and facilities for a full range of research in both speech pathology and audiology. Areas in which active research programs are under way include: oral sensory physiology; aphasia and neurogenic communication disorders; speech perception in

normal and hearing-impaired populations; speech synthesis; pediatric and adult aural rehabilitation; voice disorders; phonological development and disorders; childhood language acquisition; stuttering; central auditory dysfunction; electrophysiological assessment of auditory function in infants and neurologically impaired individuals; psychoacoustics; and language disorders in infants, preschool, and school-age children.

SPEECH AND HEARING SCIENCE (SHS)

SHS 401 Introduction to Audiologic Evaluation. (3) F

Measurement of the basic audiologic test battery, including audiograms, immittance, masking, and speech recognition. Prerequisites: SHS 311 and 376 and 384 *or* equivalents.

SHS 402 Modifying Communicative Behavior. (3) S

Principles and techniques of modifying speech and language behavior. Prerequisite: SHS 250 *or* equivalent.

SHS 465 Speech and Language Acquisition. (3) S, SS

Speech and language development in the normal child. Prerequisite: SHS 367 *or* equivalent. *General Studies: SB.*

SHS 485 Acquired Speech and Language Disorders. (3) S

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

SHS 496 Aural Rehabilitation. (3) S

Approaches to aural rehabilitation of children and adults. Introduction to educational audiology and assistive listening devices. Prerequisites: SHS 375 and 376 and 401 *or* equivalents.

SHS 501 Introduction to Audiologic Evaluation. (3) F

Measurement of the basic audiologic test battery, including audiograms, immittance, masking, and speech recognition. Prerequisites: SHS 311 and 376 and 384 *or* equivalents.

SHS 502 Differential Diagnosis for Audiology. (4) F

Differential diagnosis of cochlear and retrocochlear disorders, and assessment of vestibular system. 3 hours lecture, 2 hours lab. Prerequisite: SHS 401 *or* 501 *or* equivalent.

SHS 504 Hearing Aids. (4) S

Operation, application and fitting of amplification devices for the hearing impaired. 3 hours lecture, 2 hours lab. Prerequisite: SHS 401 *or* 501 *or* equivalent.

SHS 508 Pediatric Audiology. (3) F

Audiologic assessment, screening, and development considerations for infants and young children. Prerequisite: SHS 401 *or* 501 *or* equivalent.

SHS 511 Auditory Perception by the Hearing Impaired. (3) F

A study of how and why sensorineural hearing loss alters the perception of sound. Prerequisite: SHS 376 *or* instructor approval.

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

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

SHS 515 Audiologic Instrumentation and Calibration. (3) S

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* 501 *or* equivalent.

SHS 516 Auditory Evoked Potentials. (4) S

Continuation of SHS 502, including electrophysiologic assessment of peripheral and central auditory nervous system. Lecture, lab. Prerequisite: SHS 502.

SHS 545 Speech Perception by the Hearing Impaired. (3) F

Speech perceptual problems of the hearing impaired including those who have cochlear implants. Prerequisite: SHS 375 *or* instructor approval.

SHS 552 Otoacoustic Emissions as a Diagnostic Tool. (3) F

Study of the types of otoacoustic emissions, their theoretical implications and application to clinical diagnostics. Lecture, discussion, lab. Prerequisite: SHS 376 *or* instructor approval.

SHS 555 Cochlear Implants. (3) S

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

SHS 565 Speech and Language Acquisition. (3) S

Speech and language development in the normal child. Prerequisite: SHS 367 *or* equivalent.

SHS 566 Psychology of Language. (3) S

The psycholinguistic study of the production and comprehension of language across the lifespan.

SHS 567 Neural Bases of Communication Disorders. (3) F

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

SHS 570 Communication Disorders and Multicultural Populations. (3) S

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

SHS 571 Augmentative Communication and Language Programming. (3) S

Focus on individuals across the age span who are 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) F

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

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

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

SHS 574 Fluency Disorders and Treatment. (3) F

Phenomena, etiology, assessment, and theories of stuttering are presented, followed by various treatment procedures for children and adults who stutter. Prerequisite: SHS 431 *or* equivalent.

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

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

SHS 576 Neuromotor Speech Disorders. (3) S

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

SHS 577 Craniofacial Disorders of Communication. (3) S, SS

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

SHS 578 Disorders of Voice. (3) S

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) F

Focus on individuals across the age span who have feeding and/or swallowing disorders. Assessment and treatment strategies are presented. Prerequisite: SHS 567.

SHS 580 Clinical Practicum. (1–6) F, S, SS

Supervised practicum in audiology or 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) F

Study of 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) S

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* equivalents.

SHS 584 Internship. (1–6) F, S, SS

Off-campus directed experiences in audiology or 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) S

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

SHS 591 Seminar. (3) F, S, SS

Selected topics regularly offered:

- (a) Autism and Pervasive Language Disorders
- (b) Multiply Handicapped Child

SHS 596 Aural Rehabilitation. (3) S

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

SHS 792 Research. (1–12) N**SHS 799 Dissertation.** (1–15) N

Omnibus Graduate Courses. See page 57 for omnibus graduate courses that may be offered.

Computer Science

Stephen S. Yau

Chair

(GWC 206) 480/965-3190

cse.graduate.office@asu.edu

www.eas.asu.edu/~csedept

PROFESSORS

ASHCROFT, COLLOFELLO, FARIN, GOLSHANI, LEWIS,
NIELSON, TSAI, J. URBAN, YAU

ASSOCIATE PROFESSORS

BARAL, BHATTACHARYA, DASGUPTA, DIETRICH,
FALTZ, GHOSH, HUEY, KAMBHAMPATI, LINDQUIST,
LIU, MILLER, O'GRADY, PANCHANATHAN,
PHEANIS, SEN, S. URBAN

ASSISTANT PROFESSORS

BAZZI, CANDAN, GANNOD,
RICHA, WAGNER

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.

Areas of study include algorithms, software engineering, computer-aided geometric design, artificial intelligence, database and multimedia, operating systems, computer architecture, networking, and parallel and distributed systems.

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 92, 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 February 1, and the deadline for admission in the spring semester is September 1.

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 Examinations. 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 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. See "Admission to the Graduate College," page 92.

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 Examinations. 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 March 15, and the deadline for admission in the spring semester is October 15. See "Doctor of Philosophy," page 104, 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 exam will have 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/SPEAK exam prior to comprehensive examinations.

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

RESEARCH ACTIVITY

The faculty of the Computer Science and Engineering Department participate in a wide variety of both theoretical and applied research projects involving many aspects of both software and hardware. Current research topics include software engineering, graphics, computer-aided geometric design, microprocessor applications, digital system design, real-time embedded systems, declarative languages, computational linguistics, compilers, operating systems, distributed operating systems, database concepts, distributed architectures, parallel architectures, data structures, artificial intelligence, strategic decision systems, algorithms, networking and network security.

The Department of Computer Science and Engineering maintains various instructional laboratories with UNIX

workstations (Sun, Silicon Graphics, DEC, etc.), Pentium PCs, and Macintosh computers. These laboratories support special applications required for various computer science courses not available elsewhere on the ASU campus. The department has a VLSI design laboratory and two microprocessor laboratories for both Intel and Motorola processors. The department has various research laboratories with equipment directed to specific applications in addition to regular computer facilities. All computers in the department are networked, with some of the research laboratories equipped with ATM and 100 Mb/s fast Ethernet. The College of Engineering and Applied Sciences provides various servers to support client/server applications and development in the department. All computers in the department are connected through networking to Information Technology at ASU. See "Computing Facilities and Services," page 37, for information concerning equipment and services provided by IT.

COMPUTER SCIENCE AND ENGINEERING (CSE)

CSE 408 Multimedia Information Systems. (3) F

Design, use, and applications of multimedia systems. An introduction to 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) F, S

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

CSE 420 Computer Architecture I. (3) S

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

CSE 421 Microprocessor System Design I. (4) F, S

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. Prerequisite: CSE/EEE 225.

CSE 422 Microprocessor System Design II. (4) F, S

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

CSE 423 Microcomputer System Hardware. (3) S

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

CSE 428 Computer-Aided Processes. (3) A

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

CSE 430 Operating Systems. (3) F, S

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

CSE 434 Computer Networks. (3) F, S

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) A

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. *General Studies: L.*

CSE 440 Compiler Construction I. (3) F

Introduction to 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) F, S
Technologies for developing software components. Client-server computing with sockets and distributed objects. Dynamic interface discovery and invocation. Lecture, projects. Prerequisite: CSE 310 or instructor approval.

CSE 446 Client-Server User Interfaces. (3) S
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. Prerequisite: CSE 310 or instructor approval.

CSE 450 Design and Analysis of Algorithms. (3) F, S
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) A
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) F
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) F, S
Requirements analysis and design; architecture and patterns; representations of software; formal methods; component-based development. Lecture, projects. Prerequisite: CSE 360.

CSE 461 Software Engineering Project I. (3) F, S
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. Prerequisite: CSE 360.

CSE 462 Software Engineering Project II. (3) F, S
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. Prerequisite: CSE 461.

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

CSE 471 Introduction to Artificial Intelligence. (3) F, S
State space search, heuristic search, games, knowledge representation techniques, expert systems, and automated reasoning. Prerequisites: CSE 240, 310.

CSE 473 Nonprocedural Programming Languages. (3) A
Functional and logic programming using languages like Lucid and Prolog. Typical applications would be a Screen Editor and an Expert System. Prerequisite: CSE 355.

CSE 476 Introduction to Natural Language Processing. (3) A
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) S
Introduction to parametric curves and surfaces, Bezier and B-spline interpolation, and approximation techniques. Prerequisites: CSE 210, 470; MAT 342.

CSE 507 Virtual Reality Systems. (3) S
Computer generated 3D 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) A
Digital Image fundamentals, image transforms, image enhancement and restoration techniques, image encoding, and segmentation methods. Prerequisite: EEE 303 or instructor approval.

CSE 510 Advanced Database Management. (3) F, S
Advanced data modeling, deductive databases, object-oriented databases, distributed and multidatabase systems; emerging database technologies. Prerequisite: CSE 412.

CSE 512 Distributed Databases. (3) A
Fragmentation design. Query optimization. Distributed joins. Concurrency control. Distributed deadlock detection. Prerequisite: CSE 510.

CSE 513 Deductive Databases. (3) A
Logic as a data model. Query optimization emphasizing the top-down and bottom-up evaluation of declarative rules. Prerequisite: CSE 510.

CSE 514 Object-Oriented Database Systems. (3) A
Object-oriented data modeling, database and language integration, object algebras, extensibility, transactions, object managers, versioning/configuration, active data, nonstandard applications. Research seminar. Prerequisite: CSE 510.

CSE 517 Hardware Design Languages. (3) A
Introduction to hardware design languages. Modeling concepts for specification, simulation, and synthesis. Prerequisite: CSE 423 or EEE 425 or instructor approval.

CSE 518 Synthesis with Hardware Design Languages. (3) N
Modeling VLSI design in hardware design languages for synthesis. Transformation of language-based designs to physical layout. Application of synthesis tools. Prerequisite: CSE 517.

CSE 520 Computer Architecture II. (3) F
Computer architecture description languages, computer arithmetic, memory-hierarchy design, parallel, vector, multiprocessors, and input/output. Prerequisites: CSE 420, 430.

CSE 521 Microprocessor Applications. (4) A
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) A
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) N
Real and apparent concurrency. Hardware organization of multiprocessors, multiple computer systems, scientific attached processors, and other parallel systems. Prerequisite: CSE 330 or 423.

CSE 530 Operating System Internals. (3) A
Implementation of process management and synchronization, system call and interrupt handling, memory management, device drivers and file systems in UNIX. Prerequisites: CSE 430; knowledge of C language.

CSE 531 Distributed and Multiprocessor Operating Systems. (3) A
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 530 or instructor approval.

CSE 532 Advanced Operating System Internals. (3) N
Memory, processor, process and communication management, and concurrency control in the Windows NT multiprocessor and distributed operating system kernels and servers. Prerequisites: CSE 530; 531 (or 536).

CSE 534 Advanced Computer Networks. (3) F, S
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 536 Theory of Operating Systems. (3) S
Protection. Communication and synchronization in distributed systems, distributed file systems, deadlock theory, virtual memory theory, and uniprocessor and multiprocessor thread management. Prerequisite: CSE 430.

CSE 537 ATM Network Design. (3) S
Principles of ATM networks, switch architecture, traffic management, call and connection control, routing, internetworking with ATM networks, signaling, and OAM. Prerequisite: CSE 434.

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

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

CSE 550 Combinatorial Algorithms and Intractability. (3) N
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) F, S

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 556 Expert Systems. (3) N

Knowledge acquisition and representation, rule-based systems, frame-based systems, validation of knowledge bases, inexact reasoning, and expert database systems. Prerequisite: CSE 471.

CSE 562 Software Process Automation. (3) A

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) A

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

CSE 564 Software Design. (3) A

Examination of 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) A

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) A

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

CSE 570 Advanced Computer Graphics I. (3) A

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

CSE 571 Artificial Intelligence. (3) S

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

CSE 573 Advanced Computer Graphics II. (3) S

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) A

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

CSE 575 Decision-Making Strategies in AI. (3) S

Automatic knowledge acquisition, automatic analysis/synthesis of strategies, distributed planning/problem solving, causal modeling, predictive human-machine environments. Prerequisite: CSE 471 or 571 or equivalent.

CSE 576 Topics in Natural Language Processing. (3) S

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) F

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

CSE 578 Advanced Computer-Aided Geometric Design II. (3) S

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

CSE 579 NURBs: Nonuniform Rational B-Splines. (3) A

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) N**CSE 598 Special Topics.** (1–4) N

Omnibus Graduate Courses. See page 57 for omnibus graduate courses that may be offered.

Construction

W.W. Badger
Director
 (SCOB 241) 480/965-3615
 dewsc@asu.edu
 www.eas.asu.edu/dewsc

PROFESSORS

BADGER, MULLIGAN

ASSOCIATE PROFESSORS

BASHFORD, ERNZEN, KASHIWAGI, SAWHNEY, WEBER

ASSISTANT PROFESSORS

CHASEY, KNUTSON, WALSH, WIEZEL

VISITING EMINENT SCHOLAR

SCHEXNAYDER

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, analytical, and advanced sections of the GRE for admission.

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. School faculty and current facilities are adequate for a wide range of research activities related to the construction industry. Students and their supervisory committee select research topics of mutual interest.

CONSTRUCTION (CON)

CON 424 Structural Design. (3) F

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

CON 453 Construction Labor Management. (3) F, S

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

CON 455 Construction Project Management. (3) F, S

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

CON 463 Foundations. (3) S

Subsurface construction theory and practice for description, excavations, exploration, foundations, pavements, and slopes. Evaluation of specifications and plans of work. Lecture, recitation, field trips. Prerequisites: CEE 450; CON 424.

CON 468 Mechanical and Electrical Estimating. (3) F

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

CON 472 Development Feasibility Reports. (3) F, S

Integration of economic location theory, development cost data, market research data, and financial analysis into a feasibility report. Computer orientation. Prerequisite: REA 380. *General Studies: L.*

CON 477 Residential Construction Business Practices. (3) F

Topics addressed will include development, marketing, financing, legal issues, and sales. Prerequisite: CON 377 or instructor approval.

CON 483 Advanced Building Estimating. (3) F, S

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) F

Methods analysis and cost estimation for construction of highways, bridges, tunnels, dams, and other engineering works. Lecture, field trips. Prerequisites: CON 344, 383.

CON 495 Construction Planning and Scheduling. (3) F, S

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. Prerequisites: CON 383; STP 226. Pre- or corequisite: CON 389. *General Studies: CS.*

CON 496 Construction Contract Administration. (3) F, S

Survey administrative procedures of general and subcontractors. Study documentation, claims, arbitration, litigation, bonding, insurance, and indemnification. Discuss ethical practices. Lecture, field trips. Prerequisites: COM 225 or ECE 300; senior standing. *General Studies: L.*

CON 533 Strategies of Estimating and Bidding. (3) F

Course will explore 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) F

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) S

Analysis of 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) S

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) F

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

CON 561 International Construction. (3) S

An 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) F

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

CON 567 Advanced Procurement Systems. (3) S

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

CON 570 Cleanroom Construction I. (3) F

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) S

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 589 Construction Company Financial Control. (3) F

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

Omnibus Graduate Courses. See page 57 for omnibus graduate courses that may be offered.

Counseling

coe.asu.edu/psyched

MASTER OF COUNSELING

The Master of Counseling (M.C.) degree is a two-year, 60-semester-hour professional degree that prepares counselors for a number of settings, including schools, colleges, and universities, organizational settings, and a variety of mental health agencies. The M.C. program, which focuses on community counseling, is accredited by CACREP (Council for the Accreditation of Counseling and Related Educational Programs).

Applicants to the M.C. degree must submit all application materials by January 15 to be considered for admission for the following academic year.

Purpose. The two-year (60-semester-hour minimum) program leads to the professional degree Master of Counseling

(M.C.). This 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. Both practitioner and research options are available.

The M.C. degree identifies the recipient as a professional counselor and prepares individuals to work in a variety of human service fields. Certified teachers who complete this degree are eligible for school counselor certification in Arizona and most other states.

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 accepted any time but must be completed before January 15 for admission for the following fall semester. 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. For more information, applicants should consult the Division of Psychology in Education.

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 and to prepare, administer, and evaluate the final examination(s).

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 the Graduate College.

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 or prepare a final written paper.

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

Counseling Psychology

Elsie Moore
Director

(EDB 301) 480/965-3384

dpe@asu.edu

coe.asu.edu/psyched

PROFESSORS

BERNSTEIN, CLAIBORN, HACKETT, HORAN, KERR,
KINNIER, McWHIRTER, ROBINSON KURPIUS, TRACEY

ASSOCIATE PROFESSOR

ARREDONDO

ASSISTANT PROFESSORS

MATTHEWS, OTA-WANG

CLINICAL ASSOCIATE PROFESSOR

HOMER

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 by January 15 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. Moreover, candidates for the doctorate must complete a College of Education core course, COE 501 Introduction to Research and Evaluation in Education. See "College of Education (COE)," page 181. 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.

RESEARCH ACTIVITY

In addition to conducting research in career development and self-efficacy, faculty and students are involved in a variety of other projects, including school-based drug abuse prevention, adolescent suicide prevention, problem-solving and decision making, interpersonal and counselor skill development, professional ethics, small group process, consultation, the counseling process, counseling the gifted and talented, health psychology, and specialized problems of women and minorities. Behavioral health topics, including smoking, eating disorders, cancer, arthritis, pain control, cognitive, and stress and burnout are also studied.

COUNSELING PSYCHOLOGY (CPY)

CPY 613 Child Counseling. (3) N

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

CPY 622 Group Counseling. (3) F, S

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

CPY 634 Organizational Development and Planned Change. (3) N

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

CPY 644 Psychology of Careers. (3) S

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

CPY 645 Professional Issues and Ethics. (3) F, S

Ethical, legal, and professional issues of concern to practitioners and researchers functioning in a variety of settings. Prerequisites: CED 512 and 523 or equivalents.

CPY 667 Patterns of Behavior Disorders. (3) A

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

CPY 671 Multicultural Counseling. (3) F

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) A

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

CPY 674 Counseling Women. (3) F

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) N

Theory, research, and practice in health and wellness counseling. Prerequisite: CED 577.

CPY 677 Advanced Counseling. (3) N

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

CPY 679 History and Systems of Psychology. (3) A

Examination of 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) F

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

CPY 702 Research Methods in Counseling Psychology. (3) A

The application of experimental and/or quasi-experimental methods to theory construction and treatment evaluation in counseling psychology. Prerequisite: COE 502 or equivalent.

Omnibus Graduate Courses. See page 57 for omnibus graduate courses that may be offered.

Counselor Education

Elsie Moore

Director

(EDB 301) 480/965-3384

dpe@asu.edu

coe.asu.edu/psyched

PROFESSORS

BERNSTEIN, CLAIBORN, HACKETT,
HORAN, KERR, KINNER, McWHIRTER,
ROBINSON KURPIUS, TRACEY

ASSOCIATE PROFESSORS

ARCINIEGA, ARREDONDO, HOOD

ASSISTANT PROFESSORS

FISHER, MATTHEWS, OTA-WANG

CLINICAL ASSOCIATE PROFESSOR

HOMER

The faculty in the Division of Psychology in Education offer graduate programs leading to the Master of Counseling and Master of Education degrees in Counselor Education.

MASTER OF EDUCATION

The M.Ed. degree in Counselor Education is designed for teachers seeking a greater understanding of student behavior and information regarding pupil personnel services. This program requires 30 semester hours of graduate course work. Candidates for the M.Ed. degree must complete the College of Education core for master's students, which amounts to nine semester hours. The core courses are COE 501, 504, and 505. See "Courses," page 181. All applicants must submit scores of the Graduate Record Examination or the Miller Analogies Test.

Applicants to the M.Ed. degree must submit all application materials by October 15 or April 15 to be considered for the following semester. Students who complete the M.Ed. degree in Counselor Education and who wish to be certified as school counselors may apply to the program area for admission to an additional sequence of 18 semester hours

See "Master of Education," page 180, for more information.

RESEARCH ACTIVITY

Counselor Education faculty are engaged in the study of various topics, including counselor training, student development, gerontological counseling, ethics and professional issues, marriage and family counseling, the counseling process, counseling the gifted and talented, career development, and at-risk youth.

COUNSELOR EDUCATION (CED)

CED 512 Introduction to Helping Relationships and Community Counseling. (3) F, S, SS

Introduction to the skills used in the helping professions and an examination of the settings in which they occur.

CED 522 Personality Development. (3) F, S, SS

Interaction of affective and cognitive factors in personality development at different age levels. Various personality theories examined.

CED 523 Psychological Tests. (3) F, S, SS

Standardized tests in the study of the individual, with emphasis on test score interpretation in counseling.

CED 534 Occupations and Careers. (3) F, S, SS

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

CED 545 Analysis of the Individual. (3) F, S, SS

Theory and methods commonly used in studying the individual. Observational methods, diagnostic interviews, structured, and semi-structured methods for assessing personality. Pre- or corequisite: CED 523.

CED 567 Group Procedures. (3) F, S, SS

Social psychological factors determining interaction, effectiveness, and morale in small groups. Techniques of observation, assessment, and leadership.

CED 577 Counseling. (3) F, S, SS

Principles and application of counseling with particular emphasis on counseling theories. Prerequisites: CED 512, 534, 545; admission to M.C. or school counselor certification program.

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

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 656 The American College Student. (3) S

Provides overview of American college student from demographic, background characteristics and values/attitudes/perspectives. Includes access, persistence, and degree completion. Lecture, group discussion, and research projects. Cross-listed as HED 679. Credit is allowed for only CED 656 or HED 679.

CED 672 Marriage and Family Counseling I. (3) F

Introduction to marriage and family counseling theories. Emphasis is on a systems-communication model utilizing cocounseling.

CED 684 Internship in Community Counseling. (3-6) F, S, SS

Omnibus Graduate Courses. See page 57 for omnibus graduate courses that may be offered.

Creative Writing

Interdisciplinary Master's Program

Beckian Fritz Goldberg

Director, Executive Committee

(LL 307C) 480/965-7454

enggrad@asu.edu

www.asu.edu/clas/english/creativewriting

English

Regents' Professors: Dubie, Rios;
Professors: Boyer, Carlson, Rhodes;
Associate Professors: Goldberg, Savard;
Assistant Professor: Pritchard

Theatre

Professors: Bedard, Mason;
Associate Professors: Edwards, Engel;
Assistant Professor: Reyes

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 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 the Graduate College. Of these, 24 semester hours must be creative writing courses and must include nine hours of ENG 580, nine hours of ENG 455, 594, or 598. The course

594 Conference and Workshop may be taken twice to varied offerings. The literature component of 24 hours must include ENG 591 and two of the following courses: ENG 441, 443, 454, 457, and 458. In playwriting, the program of study requires a minimum of 60 hours of graduate credit approved by the student's supervisory committee, the director of the Creative Writing Committee, and the dean of the Graduate College. The program of study must include the following: THP 519 (6 hours), 560 (15 hours), 561 (3 hours), 598 (3 hours), and 693 (9 hours). The literature component of 24 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 hours of literature credit applied to the M.F.A. program of study. A maximum of nine 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 the Graduate College. 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 or THP 693 Practicum 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 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," "Literary Management for Theatre," and other multigenre literature and writing courses.

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 195, "Theatre (THE)," page 319, and "Theatre Performance and Production (THP)," page 319.

Curriculum and Instruction

Nicholas Appleton
Director

Robert B. Rutherford Jr.
Graduate Director
(ED 409) 480/965-1644
karen.schultz@asu.edu
coe.asu.edu/candi

PROFESSORS

BAKER, BARONE, BITTER, CHRISTIE, EDELSKY, FALTIS,
FLORES, GREATHOUSE, GRYDER, GUZZETTI,
HUDELSON, McGOWAN, McISAAC, PIBURN,
RUTHERFORD, SEARFOSS, STAHL, STALEY, ZUCKER

ASSOCIATE PROFESSORS

ANDERSON, ARIAS, BENAVIDES, BLUMENFELD-JONES,
COHEN, COHN, DI GANGI, GOMEZ, KNAUPP, McCOY,
MIDDLETON, J.C. NELSON, J.R. NELSON, RADER,
SURBECK, VALLEJO

ASSISTANT PROFESSORS

ANIJAR, BRUSH, FISCHMAN, LAMOREY, MacSWAN,
McQUILLAN, ROBERTS, ROLSTAD, TRUJILLO,
TSE, YOUNG

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 169, 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 a M.Ed. or the Postbaccalaureate Program for Teacher Certification.

M.A., M.Ed., and Ed.D. students majoring in Curriculum and Instruction complete requirements by choosing one of the following concentrations: bilingual education, communication arts, early childhood education, elementary education, English as a second language, Indian education, mathematics education, multicultural education (currently applications are not being accepted), reading education, science education, secondary education, and social studies education. An additional concentration in curriculum studies is available in the Ed.D. program.

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,
3. provide proof of teacher certification (photocopy of the certificate[s] held), and
4. provide three letters of recommendation.

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

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 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 18 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. Those interested in qualifying for one of these endorsements should seek advising from a faculty member in the program area.

Postbaccalaureate Program for Teacher Certification.

The postbaccalaureate initial teacher certification program offers, to those who have completed baccalaureate degrees outside the College of Education, course work needed to qualify for Arizona teacher certification. Postbaccalaureate programs are offered in bilingual education, early childhood education, elementary education, secondary education, and special education. Concurrent postbaccalaureate teacher certification and admission to the M.Ed. program in special education is required for those seeking certification by the State of Arizona. This requirement is waived for Postbaccalaureate Program for Teacher Certification applicants in special education 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 Postbaccalaureate Program for Teacher Certification students should contact the Office of Student Affairs (EDB 7) for information about specific admission requirements. Those interested in combining preparation for initial teacher certification with pursuing a master's degree should also contact the Curriculum and Instruction Graduate Programs Office (ED 412).

MASTER OF ARTS

See "Master's Degrees," page 101, for general requirements.

MASTER OF EDUCATION

Those seeking a master's degree and initial certification by the State of Arizona are admitted concurrently to the respective M.Ed. degree and corresponding Postbaccalaureate Program for Teacher Certification option.

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 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 will 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 180, for information on the Doctor of Education degree.

RESEARCH ACTIVITY

The research activity of faculty and graduate students emphasizes the following areas of study.

Bilingual/Multicultural Education. Identification, assessment and evaluation of minority language populations; Native American education; parent and community involvement; second language acquisition; literacy/biliteracy development in school settings; sociolinguistics; development and education of children and youth from diverse cultural, linguistic, and racial/ethnic populations; professional preparation in bilingual and English as a second language.

Early Childhood Education. Cross-cultural differences in child-rearing expectations and parent-child relations; professional preparation of early childhood education personnel; teacher preparation practices; infant and toddler development; constructivist approaches to content area learning and play education.

Elementary Education. Pedagogical practices in elementary education; policy and sociological concerns; mathematics discourse and instructional methods; outdoor education;

school, technology, and society education (STS); science education methods and materials; language learning; sociolinguistics; school-university collaboration; cognition; social studies pedagogy; middle school teaching practices.

Reading Education. Development of literacy; children and adolescent literature; discourse analysis; psycholinguistic and sociolinguistic aspects of reading; content area reading; developmental reading; assessment and remediation of reading problems; children's play and literacy development.

Secondary Education. Critical theory; curriculum development; equity and diversity; pedagogical practices in the sciences; social studies education; learning theory; issues and trends in secondary education; business education; essential elements of effective instruction; teacher-student interactions; collaborative instructional techniques.

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

BILINGUAL EDUCATION (BLE)

BLE 511 Introduction to Language Minority Education. (3) A Historical, philosophical, theoretical, and pedagogical foundations of language minority education in the United States.

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

BLE 515 Instructional Methods for Bilingual Students. (3) F An introduction to general dual language teaching approaches and assessment strategies. Focuses on the effective teaching of limited-English-proficient populations. Prerequisite: BLE 511.

BLE 520 ESL For Children. (3) S Examines approaches to second language development and assessment for children congruent with recent research in second language acquisition in children. Prerequisite: BLE 511.

BLE 521 Primary/Elementary Communication Arts in Bilingual Education. (3) S Examination of bilingual/biliterate development of elementary school children, bringing together native and second language, oral language, and literacy development findings with educational practices. Prerequisite: BLE 511.

BLE 522 Literacy/Biliteracy Development. (3) F 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. Prerequisite: BLE 511.

BLE 524 Secondary Sheltered ESL Content Teaching. (3) F Teaching and assessing ESL adolescents in the content areas with an emphasis on integrating language acquisition principles with content learning. Lecture, small group work. Corequisite: BLE 541.

BLE 528 Social Studies for Bilingual/ESL Teachers. (3) S Provides language and instructional methodologies and assessment strategies relevant to bilingual/multicultural students in social studies content delivered in Spanish and English. Prerequisite: BLE 511.

BLE 533 Literacy in Secondary BLE/ESL Settings. (3) S
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. Prerequisite: BLE 511.

BLE 535 Sociolinguistic Issues in Bilingual Education. (3) F
Survey of major theoretical issues (e.g., language situations, communicative competence, language attitudes) interrelating language, social processes, and bilingual education. Prerequisite: BLE 511.

BLE 541 Nature of Bilingualism/Second Language Acquisition. (3) A
Bilingual and second language acquisition, with emphasis on children and adolescents. Cognitive, social, and cultural aspects are stressed. Prerequisite: BLE 511.

BLE 543 Bilingual Education Models. (3) A
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. Prerequisite: BLE 511.

BLE 561 Parent Involvement in Language Minority Education Programs. (3) F, S
Examines issues, approaches, and strategies for improving parental and community involvement in the schooling of language minority children and youth. Prerequisite: BLE 511.

BLE 565 Literature for Hispanic Youth/Literatura para Jóvenes Hispanoparlantes. (3) S
Selecting, analyzing, and utilizing literature for Hispanic and Spanish speaking children and adolescents. Cross-listed as LIS 565. Credit is allowed for only BLE 565 or LIS 565.

BLE 580 Practicum. (1–6) F, S
Provides for practical application in school settings of principles of bilingual education or English as a Second Language. Special permission required.

Omnibus Graduate Courses. See page 57 for omnibus graduate courses that may be offered.

CURRICULUM AND INSTRUCTION (DCI)

DCI 510 Teacher as Researcher. (3) F, S, SS
Introduces teacher research as a new research genre; offers teachers guidance on planning and conducting research on their practice. Lecture, workshop.

DCI 591 Seminar. (1–12) N

DCI 701 Curriculum Theory and Practice. (3) F, S
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.

Omnibus Graduate Courses. See page 57 for omnibus graduate courses that may be offered.

BUSINESS EDUCATION (BUE)

BUE 480 Teaching Business Subjects. (3) S
Organization and presentation of appropriate content for business subjects in the secondary school.

BUE 481 Technology in Business and Vocational Education. (3) S 2002
Emerging curricula and instructional technology in business and vocational education. Lecture, hands-on computer instruction.

BUE 501 Principles of Business Education. (3) F
History, philosophy, principles, and objectives of business and distributive education.

BUE 502 Organization and Management of Cooperative Programs. (3) F
Work-study programs for business occupations in high schools and community colleges.

BUE 503 Competency-Based Business and Vocational Education. (3) S
Development and administration of competency-based individualized programs in business and vocational education.

BUE 505 Current Literature in Business and Vocational Education. (3) S
Critical analyses, generalizations, and trends in business and vocational education.

BUE 506 Information Processing for Business and Vocational Teachers. (3) SS
Development of curriculum and strategies for teaching information processing; hardware/software evaluation and equipment acquisition techniques in business and vocational education.

Omnibus Graduate Courses. See page 57 for omnibus graduate courses that may be offered.

EARLY CHILDHOOD EDUCATION (ECD)

ECD 501 Interprofessional Collaboration. (3) F
Dispositions, knowledge, experiences, and skills necessary for interprofessional collaboration required of professionals who work with multineed families with young children. Prepares students 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) S
Examination of bilingual/biliterate development of elementary school children, bringing together native and second language, oral language, and literacy development findings with educational practices. Prerequisite: BLE 511.

ECD 522 Developmental Social Experiences in Early Childhood Education. (3) F
Materials, techniques, aesthetic expression, creative activities, and values in the integrated curriculum.

ECD 525 Communication Arts in Early Childhood Education. (3) S
Problems and trends of current programs and oral language development. Effort to bring together language acquisition findings with educational practices. Opportunity for self-directed learning/study.

ECD 527 Mathematics in Early Childhood Education. (3) F
Theory and practice in the use of manipulative materials for teaching mathematics to preschool and primary grade children. Prerequisite: ECD 402 or equivalent.

ECD 544 Play Education. (3) S, SS
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) F, SS
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) F, SS
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) A
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) S
A critical examination and use of developmentally appropriate evaluative procedures for children from birth through age eight.

Omnibus Graduate Courses. See page 57 for omnibus graduate courses that may be offered.

ELEMENTARY EDUCATION (EED)

EED 511 Principles of Curriculum Development. (3) F, S, SS
Contemporary curriculum theories. Curriculum as an interrelated entity. Principles of conceiving and effecting change.

EED 526 Communication Arts in the Elementary School. (3) S, SS
A school 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) F, SS
Problems and trends of current programs. Development of a balanced and articulated program of social studies.

EED 529 Science in the Elementary School. (3) S
Problems and trends of current programs. Development of a balanced and articulated science program.

EED 530 Outdoor/Environmental Education. (3) SS

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) F, SS
Contemporary mathematics teaching. Content, materials, and approaches to instruction.

EED 538 Teaching Social Studies with Literature. (3) F, SS
Develops the rationale, resources, and strategies for adopting a literature-based approach to social studies teaching in grades K–8. Lecture, discussion, cooperative learning. Prerequisite: EED 455 or equivalent.

EED 578 Student Teaching in the Elementary School. (9–15) F, S
Supervised teaching for postbaccalaureate students, synthesized experience in curriculum, instruction, and classroom management. Prerequisites: completion of 21 hours of identified course work from an approved program of study; a GPA of 2.50 (postbaccalaureate non-degree) or 3.00 (postbaccalaureate degree); approval of the Office of Professional Field Experiences.

EED 581 Diagnostic Practices in Mathematics. (3) F, S
Specific skills in diagnosing/treating children's learning difficulties in mathematics. Includes practicum experiences, both on and off campus, in identifying strengths/weaknesses and initial remediation.

EED 598 Special Topics. (1–4) N

- (a) Using Math Manipulatives/Elementary Schools
- (b) Using Math Manipulatives/Middle Schools

EED 720 Language in Education. (3) A

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

Omnibus Graduate Courses. See page 57 for omnibus graduate courses that may be offered.

INDIAN EDUCATION (IED)**IED 430 Issues in Language and Literacy of Indigenous Peoples.** (3) S

Examines issues, policies, theoretical foundations, and practices of indigenous peoples and other language minority communities from a sociolinguistics and language reclamation perspective. *General Studies: HU.*

IED 460 Yaqui History and Culture. (3) F

Yaqui history and culture ranging from precontact to the present. Larger themes of Yaqui identity, belief systems, family, traditions, community, resistance, dispersion, and survival. *General Studies: SB, H.*

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

Emphasis on educational leadership research and practice in the schooling of American Indian students. Effective practices will be examined.

IED 510 History of American Indian Education. (3) F, S
Philosophical and historical review of the development of American Indian education policies in both traditional and contemporary society.

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

Examines issues, policies, theoretical foundations, and practices of indigenous peoples and other language minority communities from a sociolinguistics and language reclamation perspective.

IED 560 Yaqui History and Culture. (3) F

Yaqui history and culture ranging from precontact to the present. Larger themes of Yaqui identity, belief systems, family, traditions, community, resistance, dispersion, and survival.

IED 594 Workshop in Indian Education. (6) SS
Curriculum, pedagogy, community involvement, current issues, and research will be examined.

Omnibus Graduate Courses. See page 57 for omnibus graduate courses that may be offered.

LIBRARY SCIENCE (LIS)**LIS 410 Children's Literature.** (3) F, S, SS

Selecting, analyzing, and using modern and classic literature with young readers.

LIS 510 Computers and Technology in the School Library. (3) F
Library uses of technology and computers. Fundamental concepts and issues in library media centers. Prerequisites: LIS 571 and 581 or instructor approval.

LIS 533 Current Library Problems. (3) F

Critical analysis of current practices and problems in school librarianship. Prerequisites: LIS 540 and 561 and 571 and 581 or instructor approval.

LIS 540 Classification and Cataloging. (3) F

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

LIS 561 Selection of Library Materials. (3) F

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

LIS 563 Children's Literature. (3) F, S, SS

Selecting and using 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) S

Selecting, analyzing, and utilizing literature for Hispanic and Spanish speaking children and adolescents. Cross-listed as BLE 565. Credit is allowed for only BLE 565 or LIS 565.

LIS 571 Basic Reference Resources. (3) S

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

LIS 581 School Library Administration. (3) S

Administration of K–12 libraries and media centers.

LIS 584 School Library Internship. (1–6) F, S

Prerequisites: LIS 410, 540, 561, 571, 581; instructor approval.

Omnibus Graduate Courses. See page 57 for omnibus graduate courses that may be offered.

READING EDUCATION (RDG)**RDG 481 Reading Practicum.** (3) F, S, SS

Application of concepts from RDG 414 in classroom settings. Students demonstrate teaching strategies under supervision. Required for Elementary Education candidates. Corequisites: DCI 396; RDG 414.

RDG 505 Developmental Reading. (3) F, S, SS

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) F, S, SS

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

RDG 522 Literacy/Biliteracy Development. (3) F

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. Prerequisite: BLE 511.

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

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. Prerequisite: BLE 511.

RDG 544 Secondary Reading Programs. (3) S

Examines rationale for secondary reading programs (grades 7–12), teaching strategies, research, and program assessment. Prerequisite: RDG 507.

RDG 550 Practicum Experiences in Reading. (3) F, S, SS

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

RDG 556 Assessment Procedures in Reading. (3) F, S

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

RDG 557 Advanced Reading Practicum. (3) F, S
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. Prerequisites: RDG 505; instructor approval.

RDG 563 Children's Literature. (3) F, S, SS
Selecting and using 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 581 Literature-Based Reading Programs. (3) F, S, SS
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. Introduction to literature studies. Prerequisite: teaching certificate.

RDG 582 Practicum: Literature Studies. (3) S
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) S
Influence of gender and culture on written, oral, and post-typographical texts. Seminar.

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

Omnibus Graduate Courses. See page 57 for omnibus graduate courses that may be offered.

SECONDARY EDUCATION (SED)

SED 400 Principles of Effective Instruction in Secondary Education. (3) F, S, SS
Different models of education are examined. Appropriate teaching practices for each model are developed and applied to secondary school classrooms. Lecture, discussion. Prerequisite: PTPP admission.

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

SED 501 Introduction to Effective Instruction. (6) F, S, SS
Introductory course for postbaccalaureate certification program in secondary education. Emphasis upon developing basic classroom management, instruction, and evaluation. Includes a field assignment of at least 120 hours. Prerequisite: admission to postbaccalaureate certification program.

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

SED 533 Improving Instruction in Secondary Schools. (3) F, S, SS
Analyses of procedures, methods, techniques, and experiments in teaching in secondary schools. Prerequisites: SED 478, 578.

SED 577 Issues and Trends in Secondary Education. (3) N
Analyses of lay and professional reports; problems and issues in American secondary education. Prerequisites: SED 478, 578.

SED 578 Student Teaching in the Secondary Schools. (3–12) F, S
The practice of teaching. The relationship of theory and practice in teaching. Postbaccalaureate students only. Prerequisites: completion of approved postbaccalaureate program; a minimum 2.50 GPA; approval of the Office of Professional Field Experiences.

SED 588 Human Relations in the Secondary Schools. (3) A
Problems in human relations inherent in the interaction of pupils, teachers, administrators, nonprofessional staff, and laymen. Prerequisites: SED 478, 578.

SED 598 Special Topics. (1–4) N
(a) Using Math Manipulatives/Middle Schools

SED 711 Secondary Curriculum Development. (3) S, SS
Theories and processes of developing curriculum; evaluation of research. Prerequisites: SED 478, 522 (or equivalent), 578.

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

Omnibus Graduate Courses. See page 57 for omnibus graduate courses that may be offered.

Curriculum and Instruction

Interdisciplinary Doctoral Program

Robert B. Rutherford Jr.

Program Director

(ED 305) 480/965-4602

rutherford@asu.edu

tikkun.ed.asu.edu/coe/candi

Biology

Professor: Lawson

Chemistry and Biochemistry

Professor: Birk

Communication

Professor: Arnold

Curriculum and Instruction

Professors: Baker, Barone, Bitter, Christie, Edelsky, Faltis, Flores, Greathouse, Guzzetti, Hudelson, McGowan, Mclsaac, Piburn, Rutherford, Staley, Zucker;
Associate Professors: Arias, Blumenfeld-Jones, Cohn, Di Gangi, Gomez, McCoy, Middleton, Nelson, Surbeck;
Assistant Professors: Anijar, Lamorey, MacSwan

Educational Leadership and Policy Studies

Regents' Professor: Berliner;

Professor: Richardson;

Assistant Professor: Margolis

English

Professors: Donelson, Nilsen

Exercise and Physical Education

Professors: Burkett, Corbin, Darst, Pangrazi, Stone;
Assistant Professors: Chen, Phillips, Swan

Family Resources and Human Development

Professor: Manore;

Associate Professor: Vaughan

Mathematics

Professor: Leonard;

Assistant Professor: Carlson

Music

Professor: Humphreys;

Associate Professor: Stauffer

Physics and Astronomy

Professor: Hestenes

Psychology in Education

Associate Professor: Cohn

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. curriculum studies;
2. early childhood education;
3. educational media and computers (applications for this program are not being accepted at this time);
4. elementary education;
5. english education;
6. exercise and wellness education;
7. language and literacy;
8. mathematics education;
9. music education;
10. physical education;
11. science education; and
12. 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 the Graduate College, 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 104, 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 examination. 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 the Graduate College.

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 the Graduate College. 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 the Graduate College.

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 the Graduate College. 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 591 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 broad 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 Examinations. 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.

RESEARCH ACTIVITY

Faculty in the Interdisciplinary Ph.D. Degree Program in Curriculum and Instruction are engaged in a variety of research activities. Representative examples may be found under the program descriptions that correspond to the areas of concentration of this degree program.