1995

Graduate Catalog/Supplement 1995-1998

Utah State University

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1997-1998 Supplement
to the
1995-1997 Graduate Catalog
(Transition to Semesters)

School of Graduate Studies
Utah State University
Logan UT 84322-0900

Telephone (801) 797-1189
Supplement

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Materials for Persons with Disabilities

This catalog is available in large print, audio, and braille format upon request to the USU Disability Resource Center.

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Send address changes to Utah State University, School of Graduate Studies, 0900 University Blvd., Logan UT 84322-0900.
USU Mission Statement

Utah State University integrates teaching, research, extension, and service to meet its unique role as Utah’s land-grant university. Students are the focus of the University as they seek intellectual, personal, and cultural development.

The mission of Utah State University is to provide high quality undergraduate instruction, excellent general education, and specialized academic and professional degree programs. USU is committed to preparing students to serve the people of Utah, the nation, and the world.

USU provides nationally and internationally acclaimed programs of basic and applied research. USU engages in research to further the quest for knowledge and to help society meet its scientific, technological, environmental, economic, and social challenges.

Outreach to Utah’s citizens through extension and service programs is central to the University’s mission. The University’s outreach programs provide to individuals, communities, institutions, and industries throughout the state services that help improve technology, the environment, and quality of life.

In all its endeavors, the University is committed to developing responsible citizens through freedom of inquiry and expression, and through its best efforts in teaching, research, creative arts, extension and service, and encouraging cultural diversity.
The Semester Conversion

Beginning Fall 1998, Utah State University will be on a semester calendar. As this Supplement to the 1995-1997 Graduate Catalog goes to press, faculty are working on the conversion from the quarter calendar. The purpose of the Supplement is to provide a bridge to Fall 1998, when the first Graduate Catalog for the semester calendar will be published.

Plan, Plan, Plan!

This Supplement provides information for 1997-1998, the last year of the quarter calendar. If you will complete your graduate degree by the end of Summer Quarter 1998, the Supplement and the 1995-1997 Graduate Catalog contain the information you need. However, if you are in a USU graduate degree program and the coursework for your degree will not be completed before USU goes on the semester calendar, you will need to plan carefully. Meet with your major professor (advisor) regularly, take responsibility for learning about semester courses and any program changes, plan your completion carefully, and be certain that the needed paperwork is filed in the School of Graduate Studies Office.

Special forms will be available for graduate students who will have both quarter and semester courses from USU on their Program of Study. Two scenarios are possible:

1. The student’s Program of Study has been approved by the graduate dean, but it includes quarter classes that will not be available because of the semester conversion. A graduate student in that situation must submit a Program of Study Amendment Form to the School of Graduate Studies Office.

2. A Program of Study form that has not yet been submitted to the School of Graduate Studies will include both quarter and semester courses. A graduate student in that situation must be certain to use the new Semester Program of Study form.

Both forms are available in your department or in the School of Graduate Studies Office.

With careful planning, students should not be disadvantaged by the conversion to semesters. Your supervisory committee and department, and the School of Graduate Studies, will work with you to ensure that the semester conversion does not jeopardize your degree completion. You will, however, have to take responsibility for working with your major professor and supervisory committee to plan your program and submit the needed forms for program approval.

What Is This Supplement?

Most information about graduate programs at USU is in the 1995-1997 Graduate Catalog with which this Supplement is bound. The Supplement contains, along with the academic calendars for 1997-98 and 1998-99 (the first year of the semester calendar), changes in School of Graduate Studies policies and regulations, degrees, and quarter-calendar graduate courses since the 1995-1997 Graduate Catalog was published. For information about any such items, be sure to check the Supplement along with the 1995-1997 Graduate Catalog. Minimum credit requirements for graduate degrees beginning Fall 1998, when USU goes on the semester calendar, are also listed. Information about semester-calendar graduate courses will be made available during 1997-98 in “The Comparable-Course Newspaper” and will be listed in the 1998-1999 Graduate Catalog.

If You Need Assistance

If you have questions about the conversion to semesters and its impact on your graduate degree program, there are three major sources of information: First, for the specifics of your program, contact your major professor. Second, for information about departmental requirements and course offerings, inquire in the department office. Third, for more general questions and questions about University policies and requirements, call or visit the School of Graduate Studies Office. All will be happy to help you!!
Graduate Calendar

Summer Quarter 1997

June 9-13    Presession
June 16-20   Presession
June 23      Classes begin
July 4       Holiday (Independence Day)
July 24      Holiday (Pioneer Day)
August 15    Quarter ends
August 18-22 Postsession
August 22    Last day to complete degree requirements for summer quarter

Fall Quarter 1997

September 29, 30 New student orientation
October 1     Classes begin
November 26-28 Thanksgiving break
December 8-12 No test days
December 12   Last day of classes
December 15-18 Final examinations
December 18   Last day to complete degree requirements for summer quarter

Winter Quarter 1998

January 5    Classes begin
January 19   Holiday (Human Rights Day)
March 9-13   No test days
March 13     Last day of classes
March 16-18  Final examinations
March 18     Last day to complete degree requirements for summer quarter

Spring Quarter 1998

March 24     Classes begin
May 25       Holiday (Memorial Day)
May 26-June 1 No test days
June 1       Last day of classes
June 2-5     Final examinations
June 5       Last day to complete degree requirements for summer quarter
June 6       Hooding
June 7       Commencement

Summer Quarter 1998

June 8-12    Presession
June 15-19   Presession
June 22      Classes begin
July 3       Holiday (Independence Day)
July 24      Holiday (Pioneer Day)
August 12    Quarter ends
August 17-21 Postsession
August 21    Last day to complete degree requirements for summer quarter

Fall Semester 1998

August 27-28 New student orientation
August 31    Classes begin
September 7  Holiday (Labor Day)
November 25-27 Thanksgiving break
December 11  Last day of classes
December 14-17 Final examinations
December 17  Last day to complete degree requirements for fall semester

Spring Semester 1999

January 7-8  New student orientation
January 11   Classes begin
January 18   Holiday (Human Rights Day)
February 15  Holiday (Presidents' Day)
March 15-19  Spring break
April 30     Last day of classes
May 3-7      Final examinations
May 7        Last day to complete degree requirements for spring semester
May 7        Hooding
May 8        Commencement
Changes in Policies and Procedures

Coursework Time Limit

Coursework for a master’s degree now goes out-of-date after 8 years rather than 6 years. The policy below replaces the second paragraph on page 26 of the 1995-1997 Graduate Catalog.

Coursework that is more than 8 years old may not be used for a graduate degree. Work experience cannot be substituted for out-of-date coursework. However, if permitted by the departmental or interdepartmental degree program policy, a supervisory committee may allow revalidation through testing, following a plan developed by the supervisory committee and approved by the dean of the School of Graduate Studies. The results must be verified in writing to the graduate dean by the student’s major professor or other person(s) responsible for the testing.

Definition of a Full-Time Graduate Student

The following definition of a full-time graduate student will be effective beginning Fall 1998. It will replace the statement on page 27 of the 1995-1997 Graduate Catalog.

To be full-time, a graduate student must be registered for (1) 9 credits; (2) 6 credits if a graduate assistant employed at .375 FTE (15 hours per week) or more; or (3) for 3 credits if:

(a) All required coursework is completed, with only thesis/dissertation research remaining, and a Program of Study and a letter from the student’s major professor verifying that only thesis/dissertation research remains for degree completion have been submitted to the School of Graduate Studies (at least 5 working days before the change in status is to occur); or,

(b) It is the semester of the student’s thesis/dissertation oral defense or, in a nonthesis degree program, the semester of completion.

Split Form Requirements

USU undergraduates who want to take graduate courses that may be used for a graduate degree at USU need to be aware of the new Split Form policy, which replaces the policy on page 27 of the 1995-1997 Graduate Catalog.

A transitional student is a Utah State University undergraduate who has received permission to file a Split Form in order to register for graduate courses. Without a Split Form, the instructor’s permission is required. A transitional student must be within 30 semester (45 quarter) credits of completing bachelor’s degree requirements, have filed an Application for Graduation in the Graduation Office, have a 3.0 or higher GPA, and have applied for admission to the School of Graduate Studies. In accordance with School of Graduate Studies admission policy (p. 25), a transitional student will not be admitted to the School of Graduate Studies until his/her bachelor’s degree is completed. A maximum of 9 semester (12 quarter) credits may be split out, and a total of not more than 12 Split Form and nonmatriculated semester (18 quarter) credits may be used in a graduate degree program, but only if approved by the student’s supervisory committee.

A Split Form, which must include one or more undergraduate courses from the student’s Application for Graduate, should be filed in the School of Graduate Studies Office, along with a copy of the Application for Graduation, before grades are posted for the quarter requested to be split. A Split Form cannot be processed after the bachelor’s degree has been closed out. The form must be signed by the undergraduate advisor and the graduate department head or departmental graduate program chair/coordinator before it is submitted to the School of Graduate Studies Office. If approved by the dean of the School of Graduate Studies, the form will be processed and forwarded to the Graduation Office. Approval of a Split Form does not guarantee acceptance to the School of Graduate Studies.

Acceptability of Undergraduate Courses

The following policy defines more clearly the number of undergraduate credits that can be used for a graduate degree, replacing the statement on page 27 of the 1995-1997 Graduate Catalog.

Course-Level Numbering and Acceptability

7000-7990 are doctorate-level courses. With supervisory committee and instructor approval, they may be taken for a master’s program.

6000-6990 are master’s-level courses.
With supervisory committee approval, they may be used in a doctoral program.

5000-5990 are advanced, upper-division courses and may be used in a graduate program if approved by the supervisory committee.

3000-4990 are junior/senior, upper-division undergraduate courses. Up to 3 semester (6 quarter) credits of coursework at this level may be used for a master’s degree, upon recommendation by the student’s supervisory committee and approval by the graduate dean. To be approved, such courses must be outside the student’s graduate-degree field and must not be required by the graduate-degree department for a related undergraduate degree. Courses that students entering the graduate program are expected to have taken as undergraduates and prerequisites for courses in a master’s degree program are not acceptable.

No more than 15 semester (22 quarter) credits of 3000-5990 coursework may be used for a graduate degree other than a doctorate without a master’s degree, for which a total of 21 undergraduate semester credits, including 3 semester credits of 3000-4990 coursework, may be used.

2990 and below are lower-division courses and are not acceptable for graduate degree programs of study.

Delay of Thesis/Dissertation Publication

Occasionally, it is in the University’s best interest to delay disclosure of the contents of a thesis or dissertation while patenting and/or commercial development possibilities are investigated or for a period of report review by a funding agency. A new policy allows the delay of publication of a thesis or dissertation through submission to the University Library and to University Microfilms International (UMI) without delaying award of the student’s degree. Details on the policy and the procedures for requesting a delay in library submission can be obtained from the dean of the School of Graduate Studies.

Master of Arts (MA) Language Requirement

The following statement (effective for graduate students who matriculate Spring 1997 and thereafter) will replace the current statement under “Master of Arts” on page 31 of the 1995-1997 Graduate Catalog.

Master of Arts. Requirements for the Master of Arts (MA) degree (except in the Art Department) include two years (approximately 15 semester credits or 25 quarter credits) of an acceptable second language, with grades of C or above (unless a higher minimum grade is required by the department), or the equivalent level of learning as determined by testing approved by the supervisory committee and the graduate dean. One year each of two languages, or the equivalent as determined by approved testing, is acceptable if approved by the student’s supervisory committee. Coursework to meet this requirement cannot have been used for another degree and cannot be more than 8 years old.

Approved testing procedures are the following:

1. Take and pass (C or above, unless the department requires a higher minimum grade) a language course at the appropriate level (i.e., the final course in a two-year sequence).

2. Take a test at USU’s Languages and Philosophy Department or at the BYU Testing Center and be certified for language equivalency for 15 or more semester (25 or more quarter) credits. Contact the USU Department of Languages and Philosophy for information on languages for which tests are available at USU and BYU and to make arrangements for testing.

3. Arrange testing at another approved university center or testing agency.

4. For an international student: (a) certification of English competency through either a TOEFL score of 550 or above, a passing score on the IELI English Proficiency Test, or completion of IELI courses; and (b) certification of a second language through 1, 2, or 3 above.

Out-of-State Tuition Waivers

The Graduate Council has affirmed the following statement of purpose and guidelines for the use of out-of-state tuition waivers:

The purpose of out-of-state tuition waivers is to assist in the recruitment of outstanding graduate students, supplement graduate assistant stipends, and support meritorious graduate students in completing their degrees. In a time of tight University budgets, careful stewardship of out-of-state tuition waiver funds is crucial.

The primary use for out-of-state tuition waivers is to support students in completing degree requirements, as indicated by courses on their Programs of Study. Graduate courses and 5000-level courses are generally acceptable, unless apparently not related to the student's degree program. If there is a question about the relevance of a graduate course to degree
requirements, a letter from the student's major professor verifying the requirement will suffice.

An undergraduate, 3000-4990 course is acceptable for a tuition waiver if (1) it is on or is to be on (as verified by a letter from the major professor) the student's Program of Study; (2) it is (a) a planned prerequisite to a first professional-degree program, (b) a prerequisite for a graduate course on (or to be on) the student's Program of Study, (c) a background course required by the student's supervisory committee.

Not acceptable for out-of-state tuition waivers are (1) undergraduate activity/recreation/personal development courses (e.g., skiing, guitar) or (2) audits at any level.

A student who uses a waiver for an unacceptable course will be required to reimburse the University for the waived tuition amount.

**Degree Changes**

**School of Accountancy**

See Interdepartmental Degrees.

**Department of Biological and Irrigation Engineering**

Dropped: Master of Science (MS) in Irrigation Science.

Added: Master of Irrigation Engineering.

**Department of Communicative Disorders and Deaf Education**

See Interdepartmental Degrees.

**Department of Electrical and Computer Engineering**

Added: Plan B option for the Master of Science (MS).

**Department of Elementary Education**

Dropped: Plan C option for the Master of Science (MS) and Master of Arts (MA).

Added: Plan C option for the Master of Education (MEd).

**Department of Health, Physical Education and Recreation**

Added: Plan C option for the Recreation Leadership and the Health Education Master of Science (MS) specializations.

**Department of Human Environments**

Added: Master of Science (MS) specialization in Interior Design.

See Interdepartmental Degrees.

**Department of Mechanical and Aerospace Engineering**

Added: Plan B option for the Master of Science (MS).

**Interdepartmental Degrees**

**PhD in Family Life**

Added: Human Environments specialization.

**Master of of Business Administration (MBA)**

Added: Accounting specialization.

**Interdepartmental Doctoral Program in Education (EdD, PhD)**

Dropped: Educational Audiology emphasis within the Curriculum and Instruction specialization.

**Semester Degree Requirements**

**Master's Degrees**

From 6 to 15 semester credits of thesis research will be required for a Plan A master's degree. At least 2 semester credits of thesis research will be required for a Plan B option, but no more than 3 credits can be used.

The minimum requirement for a Master of Science or Master of Arts degree will be 30 semester credits, except for the Plan C option, for which the minimum will be 33 semester credits. For an MEd, the minimum will be 36 semester credits. For master's degrees, at least 24 semester credits must be completed in residency, and no more than 8 workshop credits may be applied toward the degree.

In concurrent master's degrees, a maximum of 9 semester credits of overlap will be allowed.
Doctoral Degrees

The minimum requirement for a doctoral degree will be 60 approved graduate semester credits in addition to a master's degree, or 90 approved semester graduate credits without a master's degree. The 60-credit PhD program requires a minimum of 12 semester dissertation credits; the 90-credit PhD program requires a minimum of 18 semester dissertation credits.

For the PhD, a minimum of 33 semester credits must be completed in residency. At least 3 semesters of full-time registration in residence will be required. For the EdD, 39 credits must be completed in residency. At least 3 semesters in full-time registration in residence will be required; they need not be consecutive. Two of these semesters must be completed before registering for dissertation credit.

In concurrent doctoral plus master's degrees, a maximum of 15 semester credits of overlap will be allowed.

Nonmatriculated, Lower Level, and Transferred Credits

A maximum of 12 semester credits earned as a nonmatriculated student may be used in a graduate degree program, but only if approved by the student's supervisory committee.

For use of undergraduate coursework in a graduate degree program, see pages 7-8 of this Supplement. Only 12 semester credits earned before matriculation at USU may be transferred.

Quarter Course Changes

College of Education

655* (0666). Research for Classroom Teachers. Assists teachers in applying research methods to classroom problems, in locating, interpreting, and using research reports, and in writing research-related papers on teaching. (3F,Sp)

667* (0667). Introduction to Educational and Psychological Research. Identifying a research problem, reviewing and evaluating the research literature, designing and carrying out a research project. Research area should be identified before enrolling. Prerequisite: Psy 380. (3F,Sp,Su)

660. Descriptive and Inferential Statistics I. Introduction to General Linear Model as a basis for statistical analysis. Emphasis on correlation and regression and associated inferential procedures. Prerequisite: Psy 380; Educ/Psy 655 or Educ 655. (3F,W)

661. Descriptive and Inferential Statistics II. Continuation of Educ/Psy 660. General Linear Model used as a basis for statistical analysis, with emphasis on analysis of variance and covariance. Prerequisite: Educ/Psy 660. (3W,Sp)

670 (SpEd 670). Single-Subject Research Methods and Design. Experimental research methods employed by general and special educators, psychologists, and other related services professionals to analyze effects of instruction, treatment, and other interventions on behavior of students, clients, or other participants included in the research as individuals or members of small groups. (3F,Sp,Su)

School of Accountancy

506. Personal Financial Planning and Advising. Fundamental concepts and principles of personal financial planning for individuals, including tax issues. Students prepare plans for themselves and learn how to prepare plans for others. Prerequisites: Econ 200, Math 105, Acc 201 or 661. (4F)

507. Retirement Planning. Concepts and principles of retirement planning. Includes pension and benefit plans, deferred compensation, investments, and tax issues. Prerequisites: Econ 200, Math 105, Acc 201 or 661. (4W)

508. Estate Planning. Concepts and principles of estate planning for individuals. Includes goal identification, data gathering, forms of property ownership, documents, probate, income taxes, and transfer taxes. Prerequisites: Econ 200, Math 105, Acc 201 or 661. (4Sp)

635. Advanced Managerial Accounting. Contemporary developments in managerial accounting and control. Includes a study of the controller's function. Prerequisite: Acc 200 or 531 or 602. (4F,Sp,Su)

Department of Animal, Dairy and Veterinary Sciences

503. Sustainable Agriculture Production Systems with Animals. Study of various domestic animal production systems in relation to sustainable agriculture and integrated ranch and farm management strategies. Considerations of environmental factors and overall profitability. Prerequisite: ADS 111. (3W)

526. Methods in Biotechnology: Molecular Cloning. Laboratory-oriented course in molecular cloning techniques such as DNA cloning, genetic probes, PCR, DNA sequencing. Prerequisite: Biol 319 or Chem 570. (3F)

608 (d506). Beef Cattle Management. Managing the beef enterprise to yield optimum returns through integrating resource use and applying breeding, nutrition, reproduction, and animal health practices. Three lectures, one lab. Prerequisites: ADS 208; ADS 351, 421, 457 or concurrent enrollment. (4F)

609 (d509). Sheep Management and Wool Technology. Detailed study of the managerial considerations for range and farm operations. Examination of wool and a review of wool clip handling and merchandising. Three lectures, two labs. Prerequisites: ADS 209; ADS 351, 421, 457 or concurrent enrollment. (3Sp)

612 (d511). Swine Management. Management decisions based on nutrition, breeding, programs, herd health practices, herd records, and marketing opportunities. Three lectures, one lab. Prerequisites: ADS 315; ADS 351, 421, 457 or concurrent enrollment. (4Sp)

613 (d513). Dairy Cattle Management. Evaluating dairy herds and planning for future improvements, using management records on herd performance, individual student oral and written reports. Two lectures and one lab. Prerequisites: ADS 219; ADS 102 or 351 or concurrent enrollment; ADS 101 or 421 or concurrent enrollment; ADS 457 or concurrent enrollment. (4W)

615 (d519). Horse Management. Management decisions in horse enterprises with emphasis on records, nutrition, breeding, health, facilities, and merchandising. Three lectures, one lab. Prerequisites: ADS 219; ADS 351, 421, 457 or concurrent enrollment; business administration course recommended. (4W)

620. Physiology of Reproduction. A study of the processes of reproduction in mammals, including mechanisms of control. Three lectures, one lab. Prerequisites: Chem 141 or 231; Phys 501 and 502. (4Sp)

653 (d553). Nutritional Management of Ruminants. Nutritional management, problem solving, and feeding strategies as they influence animal performance. One lecture, two labs. Prerequisite: ADS 351. (3W)

654 (d554). Nutritional Management of Nonruminants. Nutritional management, problem solving, and feeding strategies as they influence animal performance. One lecture, two labs. Prerequisite: ADS 351. (3W)
Department of Biological and Irrigation Engineering

516. Methods in Biotechnology: Cell Culture. No longer offered in this department. See ADVS, Biology, Chemistry, NFS, or FSBio departmental listing in the 1985-1986 Graduate Catalog.

524. Methods in Biotechnology: Protein Purification Techniques. No longer offered in this department. See ADVS, Biology, Chemistry, NFS, or FSBio departmental listing in the 1985-1986 Graduate Catalog.


581. Biochemical Engineering. Fundamentals of biocreator design and bioengineering. Emphasis on mathematical models of microbial and enzymatic processes in environmental and industrial biotechnology. Prerequisites: CEE 365, and Mic 111 and 112, or Biol 125. (3W)

603 (d543). Principles of Irrigation Engineering. Soil-water-plant relationships; evapotranspiration and water requirements; effective water use; irrigation scheduling; infiltration; irrigation systems planning. Prerequisites: Engr 103 or CS 159 or equivalent; for MBA students: also CEE 343, CEE 350 or equivalent previously or concurrently. (4F)

604 (d504-505). NFS 604 (d504) or NFS 606 (d506). Food and Bioprocess Engineering. Standardization and compounding of biomaterials and food products; preservation processing using heat, refrigeration, concentration, and dehydration. Basic unit operations in the bioprocessing industry. Quality control of raw and finished bioproducts. (4Sp)

618 (d518). Engineering Aspects of Soil and Water Conservation. Erosion control structures, terraces, and outfalls, grassed waterways, soil saving dams, Tillage and farming methods including strip cropping, contouring, and land forming. Three lectures, one lab. Prerequisite: Senior-level standing. (4Sp)

625 (d525). Principles of Remote Sensing and Applications in Agriculture and Hydrology. Techniques for field-based measurements of reflected and emitted radiation as well as ancillary data collection to support airborne and satellite remote sensing studies in agriculture and hydrology. Recommended: Introductory calculus and physics. (4Sp)

671 (d580). Bioprocesses in Engineered and Environmental Systems. Applications of microbial metabolism, physiology, and ecology to degradation of waste materials in engineered systems and the environment. Prerequisites: CEE 365; Mic 111 and 112, or Biol 125. (4F)

Department of Biology

Biology

507. Elementary Models in Ecology. Elementary models in population and community ecology explored through computer simulation. Random and deterministic populations, competition, predation, food webs, and islands. No programming required. Prerequisites: Biol 386. (SW)


525. Evolutionary Biology. Current developments in evolutionary biology. Considers topics from molecular to macroevolutionary scales. Prerequisites: Biol 319 and 386. (3W)

540. Microcomputers in Biological Research. (3Sp)


632. Modeling Ecological Systems. (4W)

Botany

563. Forest Pathology. Nature, cause, and control of diseases affecting forest trees. Prerequisites: Biol 126; Bot 560 (may be concurrent). Two lectures, two labs. Also listed as FR 563. (4W)

Entomology

534. Insect Ecology. Examines the distribution and abundance of insects in natural and agroecosystems. Topics include population dynamics, life-history adaptations, species interactions, and community structure. Two lectures, one lab. Prerequisites: Ent 229 or Biol 396. (4F)

537. Aquatic Entomology. Recognition, habits, adaptations, and life histories of aquatic insects. One lecture, two labs. Prerequisite: Ent 229. (3Sp)

Microbiology

430 (d530). Soil Microbiology. Activities and ecology of microorganisms related to the soil environment, soil fertility, soil organic matter, rhizosphere, and soil amendments. Prerequisites: Biol 125; Chem 141 or 231. (3W)

Physiology

406 (d504). Comparative Animal Physiology. Survey of physiological adaptations of animal organ systems (respiratory, circulatory, digestive, and integrative) to environmental variables. Prerequisite: Biol 127. (3Sp)

501. Mammalian Physiology I. An intensive, detailed study of membrane physiology, muscle, neuromuscular, sensory, respiratory, circulatory, digestive, and body fluids. Prerequisites: Biol 127, 521; Chem 160; Phys 101 or 129, or Phys 113 or 223. (4F)

503. Endocrinology. Distinct glands and their secretions. Emphasis is placed on the action of these hormones on growth, metabolism, and adaptation of animals to changes in the internal and external environments. Three lectures, one lab. Prerequisites: Biol 127 and Chem 232. (3Sp)

505. Animal Physiology Laboratory. Intensive, hands-on course using classical preparations to train students in experimental design, data analysis, and writing research reports. Prerequisite: Phys 404 or 501. Recommended: Phys 502. (3Sp)

Public Health

510. Environmental Health. The effect of environment on human health. The control measures applied: water, air, refuse, industrial hygiene, radiation, insects, and rodents. Three lectures, one lab. Prerequisites: Biol 127; Mic 112 or 301; Chem 141 or 231. (3F)

512. Communicable Disease Control. Mechanisms of transmission, control, and prevention of communicable diseases. No prerequisites. (3F)

530. Fundamentals of Epidemiology. Introduction to the study of the distribution and causes of communicable and noncommunicable diseases in humans and other animals. Two lectures; one lab. Prerequisites: Stat 201 and PubH 512. (3W)

540. Industrial Hygiene. Fundamentals of industrial hygiene including recognition, evaluation, and control of chemical, biological, and physical agents affecting the health of workers. Three lectures, one lab. Prerequisites: Biol 127 and Chem 231. (4F)

542. Industrial Hygiene Hazard Control. Design and economic considerations affecting the control of chemical health hazards of various industrial processes, with an emphasis on ventilation. Prerequisite: PubH 541. (3Sp)

Department of Business Administration

565. Market Analysis. Develops the skills necessary to plan and implement an effective marketing strategy. Focus on the role of marketing information on managerial decision making. Marketing cases and/or simulation games used throughout the course. (3)

686. Research in Business Decision Sciences. Requires students to develop and complete a research project based on principles of business decision science. (3)

Department of Business Information Systems and Education

505. Object-Oriented Project Development. Application of the Object Model to software development. Object-based development environment used for project design, development, and maintenance. Prerequisites: BIS 310 and 350. (3)
Department of Civil and Environmental Engineering

525. Environmental Engineering Cooperative Practice. Applied environmental employment with primary focus of work experience related to one of the environmental engineering specialty areas. Prerequisites: Senior-level standing and permission of instructor. (3F,W,Su)

568(6)568). Soil-Based Hazardous Waste Management. Engineering management of hazardous wastes present in the vadose zone including extraction, containment, and destruction technologies. Aspects include engineering characterization, problem definition, treatment, and monitoring. Prerequisites: Chem 222, 124, 141; Soil 358; CEE 362. (3Sp)

571. Air Toxics and Pollution Prevention. Nature and extent of air toxics emissions from commercial and industrial facilities. Emphasis on emission controls, risk reduction, and pollution prevention. (3Sp)


669 (d561). Water Quality Analysis. Methods of physical, chemical, and biological analysis of water and wastewater; underlying principles and limitations of test methods; statistical significance of data. Two lectures, two labs. Prerequisites: Chem 122, 124; CEE 364, 365, 388. (4F)

661 (d561). Environmental Management and Regulation. Multimedia environmental quality management based primarily on current federal environmental regulations. (3F)

668 (d568). Soil Based Hazardous Waste Management. Engineering management of hazardous wastes present in the vadose zone including extraction, containment, and destruction technologies. Aspects include engineering characterization, problem definition, treatment, and monitoring. Prerequisites: Chem 222, 124, 141; Soil 358; CEE 362. (3Sp)

669 (d569) (d769H). Water Resources Engineering. Synthesis of hydraulics, hydrology, and economics of water resource systems. Prerequisites: basic fluid mechanics or CEE 350; hydrology or CEE 345; and engineering economics or CEE 420. (3F)

671 (d569). Bioprocesses in Engineered and Environmental Systems. Applications of microbial metabolism, physiology, and ecology to degradation of waste materials in engineered systems and the environment. Prerequisites: CEE 365; Mech 111 and 112, or Biol 125. (4F)

692. Chemodynamics: Movement and Fate of Chemicals in the Environment. Presentation, evaluation, and application of models of pollutant transport. Physical, chemical, and biological transformation processes in the environment. Estimation of exposure and support risk assessments. Prerequisites: CEE 367, 673, or consent of instructor. (3Sp)

Department of Communication Disorders and Deaf Education

623. Assistive Devices/Applications in Communicative Disorders. Training in the use of a range of assistive devices and applications for treatment of communicative disorders. (3W)

631. Disorders of Fluency—Stuttering. Theoretical, clinical, and experimental approaches to stuttering and other disorders of speech rhythm. (4F)

649 (d549). Language Assessment. Evaluation of the language and communication skills of prelinguistic, preschool, and school-age children, using formal and informal assessment procedures. Prerequisites: ComD 270, 510, or equivalents. (4F)

652 (d551). Language Intervention for Infants, Toddlers, and Preschoolers. Language therapy for semantic, syntactic, and pragmatic aspects of language in infants and preschool children. Includes theoretical approaches, as well as published materials, and emphasizes parental role in intervention. Prerequisite: ComD 649/649. (3W)

Department of Computer Science

565. Parallel Programming. Programming methodologies for highly parallel computers. Topics include concurrent programming, distributed programming, and implementation issues. Prerequisite: CS 220. (3F)
505. Computer Modeling and Simulation. Introduction to simulation and comparison with other techniques. Discrete simulation models and discrete change simulation. Analysis of data generated by simulation experiments and validation of simulation models and results. Prerequisites: Stat 301 and CS 171. (3F,Sp)

530. 531. Compiler Construction. Review of program language structures, translation, loading, execution, and storage allocation. Compilation of simple expressions, statements, and declarations. Organization and design of a compiler. Prerequisites: CS 220 and 479 are required for 530; CS 380 must be taken prior to 531. (3W,Sp)

541, 542. Computer Graphics. A two-semester sequence introducing the concepts of graphics techniques and digital representation of information. Prerequisites: CS 171 and Math 321 are required for 541; CS 541 must be taken prior to 542. (3F,3W)


556. Design and Analysis of Parallel Algorithms. Parallel complexity classes, models of parallel computation, and trade-offs between parallelism, programming, and performance. Parallel algorithms in a wide variety of areas. Prerequisite: CS 220. (3Sp)

577. Distributed Software Systems. Introduction to distributed software systems, including client/server and peer architectures, transparency, file and directory services, remote procedure calls, migration and replication strategies, collaborating servers, and security. Prerequisite: CS 511. (3F)

605. Advanced Parallel Programming. An advanced course in parallel programming. Topics include fine-grained synchronization, semaphores, conditional critical regions, monitors, asynchronous message passing, synchronous message passing, and RPC. Prerequisite: CS 500. (8Sp)

630. Object-Oriented Models and Methods. Study of object-oriented concepts, principle, techniques, development processes and applications in all areas of software engineering, with special emphasis on current research topics. Prerequisite: CS 427. (3F)

633. Parallel Programming. Study of computer techniques for generating code for parallel processors. Those techniques are applicable for both coarse and fine grain parallelism. Prerequisite: ECE 503. (3W)


Department of Economics

540. International Trade and Finance. Issues in intermediate international trade and finance, including noncompetitive trade theory, trade policy, and exchange rate analysis. Prerequisites: Econ 340, and Econ 401 or 501. (4W)

554. Guide to Benefit Cost Analysis and Interpretation. Terminology, data, basic economic and financial considerations required in preparation of project feasibility and funding documents. Lecture plus workshop format. Prerequisite: Econ 401 or 501. (3W)

585. Regional and Urban Economics. Building on microeconomic theory, models for regional and urban structure and change are explored. Policy decision models are also developed. Prerequisites: Econ 401 or 501, or consent of instructor. (3F)

595. Senior Agricultural Economics/Economics Project. A current problem related to agricultural economics and/or economics is identified and analyzed, bringing together other agricultural economics and economics course concepts and methods. Prerequisites: Econ 400 or 500, and Econ 401 or 501. (3Sp)

600. Income Theory. Theories of aggregate economic behavior in closed and open economies, with emphasis on formulation of policies designed to promote full employment, price stability, and economic growth. Prerequisites: Econ 500 and 631 or equivalent, or consent of instructor. (4F)

601. Price Theory I. Technology, theory of the firm, economics and organization, consumption, uncertainty, general equilibrium. Prerequisites: Econ 501 and 631 or equivalent, or consent of instructor. (4F)

602. Price Theory II. Theory of markets, strategic behavior and theory of games, theory of capital, asset markets, theory of information, externalities, public goods, and public choice. Prerequisite: Econ 601 and 632 or equivalent, or consent of instructor. (4F)

603. Agricultural Marketing and Policy. An applied marketing course dealing with application of economic theory to solution of current marketing problems. Prerequisites: Econ 601, 602, and 632, or consent of instructor. (3Sp)

604. Dynamic Macroeconomics. Advanced macroeconomic theory including dynamic models of the economy and expectations. Prerequisites: Econ 600 and 632, or consent of instructor. (4W)

605. Theory and Methods of Community Economic Development. Multidisciplinary approaches to analyzing community economic development issues in rural and urban settings. Prerequisites: Econ 506, 501, 554, 653. (3Sp)

609. Community Economic Development Project and Seminar. Provides the framework within which students conceptualize and develop their CED projects. Prerequisite: Econ 698. (3Su)

611. Advanced Mathematical Economics. Advanced mathematical theory and techniques as applied to economics, including optimization, comparative statics, dynamics, and differential equations. Prerequisites: Econ 500, 501, and 531, or their equivalent, or consent of instructor. (4F)

612. Advanced Mathematical Economics. Advanced topics in mathematical economics including optimization and Kuhn-Tucker conditions, the envelope theorem and its application to economics, and dynamic analysis. Prerequisite: Econ 631. (3F)

633 (553). Applied Econometrics. Application of basic statistics, simple linear regressions, multiple regressions, and simultaneous equations to economic models. Prerequisites: Econ 531 or its equivalent; Stat 230, or Stat 301 and 502, or their equivalent, or consent of instructor. (3F)

640. International Economics. International trade theory and policy. Most recent developments in international economics, as well as the traditional core of the subject including Ricardo Theory and Heckscher-Ohlin Theory, are covered. The monetary portion includes asset market approach to exchange rate determination. Focuses on theory, followed by application of the theory to major policy questions. Prerequisites: Econ 540, 602, and 604, or consent of instructor. (3F)

643. Econometrics I. An analysis of the commonly used and practiced techniques for estimating and testing linear economic models. For first-year graduate students. Prerequisites: Econ 531 and 602 or equivalent, or consent of instructor. (3W)

645. Operations Research. Linear programming, resource allocation models, duality theory, transportation and assignment problems, and post-optimal analysis. Prerequisites: Econ 631 and 632, Econ 632 or equivalent, or consent of instructor. (3Sp)

647. Business Forecasting Methods. Discussion and evaluation of business forecasting methods. Topics include survey design and administration, trend projection, econometric models, and input/output analysis. Prerequisites: Econ 643 and 644, or consent of instructor. (4F)

655* (555). Resource Economics. Allocative and distributive implications of using natural resources, including exhaustible, renewable, environmental, and nonmarket resources. Prerequisites: Econ 601, 602, or consent of instructor. (4F)

680. Economic Development. Theories of economic development with emphasis on measurement and empirical analysis. The concept of human development is emphasized, in addition to an explanation and determinants of economic growth in developing countries. Prerequisites: Econ 580, 602, and 604, or consent of instructor. (3W)

700. Advanced Macroeconomics Seminar. Income, monetary, and fiscal analysis. Prerequisites: Econ 690, 694, and 692, or consent of instructor. (3Sp)

701. Advanced Microeconomics Seminar. Consumer demand, the product market, production and factor demand, factor supply, economics of uncertainty, welfare economics, and general equilibrium. Prerequisites: Econ 601, 602, and 632, or consent of instructor. (3Sp)

733. Advanced Econometrics Seminar. Theory and applications of linear and nonlinear regression using quantitative and qualitative variables, simultaneous equations, and advanced topics in optimization. Prerequisites: Econ 632, 643, and 644, or consent of instructor. (3W)

755. The Economics of Natural Resource Use Seminar. Advanced topics in economic theory of optimal natural resource use under alternative assumptions of property rights, externalities, and uncertainty. Prerequisites: Econ 601, 602, 632, and 655, or equivalent, or consent of instructor. (3W)

758. Environmental Economics Seminar. Environmental economics at doctoral level including theory of policy under certainty and uncertainty, pigouvian taxation, taxation and quality standards, game theoretic approaches to environmental regulation, cost-benefit theory. Prerequisite: Econ 755. (3Sp)

760. Seminar in Financial Topics. Seminar in current finance theory. Topics will include current issues in investments, portfolio theory, corporate finance, capital markets, speculative market, and financial institutions. Prerequisites: Econ 700 and 791, or consent of instructor. (3Sp)

760. Economic Development/Trade Seminar. Economic theory and econometric methods of analyzing development, trade, and exchange are discussed. Prerequisites: Econ 662, 664, 640, and 680, or consent of instructor. (3Sp)

Department of Electrical and Computer Engineering

574* (555). Computer and Data Communication Systems. Provides a systems approach to computer and data communication. Includes data transmission, computer interfaces, and protocols relating to local and wide area networks. Three lectures and one lab. Prerequisite: ECE 377. (4Sp)

576. Memory, Storage, and Bus Systems. Memory hierarchy: cache, main memory, and virtual memory; storage systems; buses. Performance analysis, implications for system and applications software. Prerequisite: ECE 317. (3F)
577. Microcomputer Interface Design. Design of hardware and software interfaces to microcomputers for instrumentation and control applications. Three lectures, one lab. Prerequisite: ECE 377. (4S)

578. Introduction to Real-Time Systems. Issues concerning implementation of real-time systems, including synchronous programming, time, interrupts, context switch, semaphores, threads, message passing, and scheduling. Prerequisite: ECE 376. (3W)

579. Multiprocessor Systems Engineering. Low-level programming for small shared-memory and distributed-memory multiprocessor systems. Emphasis on hardware-software interaction and support for sharing resources and message-passing. Prerequisite: ECE 377. (3Sp)

586. Computer Structure. (3W)

625. Graduate Internship/Co-op. Planned work experience in industry. Detailed program; must have prior approval. (1-4F,2,Sp,Su)

Department of Family and Human Development
676. Adult Development and Aging in Social Context. Interdisciplinary perspective on developmental issues in adulthood and old age. Biocultural, cognitive, and psychosocial changes in family, community, cultural, and sociopolitical context. (3W)

Department of Fisheries and Wildlife

Watershed Science
560(3FW, 560)(3FW, 662). Aquatic Ecology Laboratory. Field, laboratory, and data analysis approaches for measuring physical, chemical, and biological parameters in lakes and streams. Required field trip. Prerequisites: FW 460, Stat 201, and NR 201, or BIS 160. (4Sp)

682. Watershed Science Seminar. Review and discussion of current literature and developments in watershed science. (2FW) (3)

Fisheries and Wildlife
516. Methods in Biotechnology: Cell Culture. No longer offered in this department. See ADVS, Biology, Chemistry, NFS, or PSBio departmental listing in the 1995-1996 Graduate Catalog.


560(3FW, 662). Aquatic Ecology Laboratory. Field, laboratory, and data analysis approaches for measuring physical, chemical, and biological parameters in lakes and streams. Required field trip. Prerequisites: FW 460, Stat 201 and NR 201, or BIS 160. (4Sp)

Department of Forest Resources
563. Forest Pathology. Nature, cause, and control of diseases affecting forest trees. Prerequisites: Biol 126, Bot 560 (may be concurrent). Two lectures, two labs. Also listed as Bot 563. (4W)

Department of Geology
631 (dS81). Global Geophysics. Fundamentals of the physics of the Earth's interior and the theory of plate tectonics, recognition of large-scale crustal deformation and plate interactions, tectonic development of North America. Three lectures and one lab per week. Prerequisites: Geol 370 and Phy 222, or consent of instructor. (4F)
691. *Readings in the Creative Process.* Readings on the nature of creativity and the creative process with focus given to design criticism, how social issues affect design, and understanding future styles. (1F)

692. *Readings in Post-Occupancy in Interior Design.* Readings to identify and define post-occupancy in interior design. (1)

693. *Readings in Design Forecasting.* Readings related to design directions, design movements, and predictive of design development. (1Sp)

710. *Theory in Human Environments.* Seminar focusing on development and use of theory in human environments. (3Sp)

775. *Advanced Topics in Human Environments.* Major topics and issues in the study of human environments. (3W) 

790. *Independent Study.* Independent readings in clothing and merchandising, consumer sciences, and family and consumer sciences education and extension. Prerequisite: Instructor’s permission. (1-3F, W, Sp)

790. *Continuing Graduate Advisement.* (1-3F, W, Sp, Su) 

**Department of Industrial Technology and Education**

574. *Welding Metallurgy Ferrous.* Metallurgy principles are applied to welding and testing steel alloys. Prerequisite: ITE 286. (4F)

575. *Welding Metallurgy Nonferrous.* Metallurgy principles are applied to welding and testing stainless steels, and alloys of aluminum, titanium, nickel, and copper. Prerequisite: ITE 574. (3W)

**Department of Instructional Technology**

581. *Essentials of Multimedia Design for Instruction.* Application of instructional systems design principles to production of multimedia for instruction and training. (3F)

583. *Producing Multimedia Resources for Instruction and Training.* Production of digital resources for computer-based instruction. Basics of scanning, image manipulation, digital sound, digital video, and developing cross-platform resources. (3F)

585. *Producing Multimedia Presentations for Group Instruction.* Production of multimedia presentations using presentation and internet homepage software, incorporating navigation, screen design, and selection of multimedia resources for group instruction. (3Sp)

584. *Advanced Production of Multimedia Resources for Instruction and Training.* Focuses on creation of original instructional multimedia animations. Animation software, digital point programs, and resource design. Prerequisite: InsT 582. (3W)

582. *Fundamentals of Authoring Languages for Multimedia Instruction.* Students will build instructional units and are introduced to authoring languages for producing multimedia instruction. Elements of presentation, practice, feedback, and data management are included. Prerequisite: InsT 581 previously or concurrently. (3F)

586. *Advanced Authoring Skills for Multimedia Instruction.* Students will produce a marketable multimedia instructional application using skills previously acquired and building on advanced authoring language skills. Prerequisite: InsT 581 and 585. (3W)

587. *Mastering Optical Media for Instruction and Training.* Students will use knowledge acquired in multimedia minor to produce and master an optical disc. (3Sp)

633. *Analysis and Design for Classroom Instruction.* Introduction to systematic techniques for teachers to perform needs analysis, task and objectives identification, and design of instructional experiences. (3)

**Department of Landscape Architecture and Environmental Planning**

692. *Master’s Project.* Master’s project subject investigation and execution. No prerequisites required, but enrollment is limited to graduate students in good standing in the LAEP Department. (3F, W, Sp, Su)

**Department of Management and Human Resources**

699. *Global Business Strategy.* An integrative capstone course, taking a senior management perspective, addressing global competitiveness, strategic assessment, policy development, and strategy execution. Also taught in Ogden. (4F/Sp)

**Department of Mathematics and Statistics**

Mathematics


563. *Numerical Analysis III.* Numerical solution of ordinary and partial differential equations, shooting methods, finite differences. Includes initial and boundary value problems, stiff equations, and parabolic and elliptic PDE. Prerequisite: Math 522, 542, 561. (3Sp)

**Department of Mechanical and Aerospace Engineering**


504. *Advanced Mechanics of Materials.* Advanced strength of materials and elementary elasticity principles, including stress analysis, nonsymmetric bending of beams, thin-walled structures, torsion, and energy methods. Prerequisite: CEE 305. (3F)

521. *Computer Control of Machines and Processes.* Computer fundamentals, interface electronics, and microprocessor utilization pertaining to manufacturing engineering. Three lectures. Prerequisites: MAP 211 and 424. (3W)

575. *Control System Design.* Design and analysis of control systems using classical design techniques for both single and multiple loop systems. Case study reviews. Three lectures. Prerequisite: MAP 424. (3Sp)

731. *Engineering Thermodynamics.* Applications of thermodynamic concepts to current areas of interest and research in mechanical and aerospace engineering. Prerequisite: Permission of instructor. (3W)

**Department of Nutrition and Food Sciences**

604 (d534) (d560). *Food and Bioprocess Engineering.* Standardization and compounding of biomaterials and food products; preservation processing using heat, refrigeration, concentration, and dehydation. Basic unit operations in the bioprocessing industry. Quality control of raw and finished bioproducts. (4Sp)

621 (d521) (d521). *Advanced Public Health Nutrition and Public Policy.* The scientific basis for public health recommendations regarding nutrition and human health will be reviewed with an emphasis on epidemiology methods and population-based studies. No prerequisite. (3Sp)

676 (d576). *Food Service Management Practicum.* Advanced practical experience in food service management for Dietetics and Culinary Arts/Food Service Management majors. Prerequisite: NFS 472 or senior standing in Culinary Arts/ Food Service Management program. (1-10W) Sp) 

714. *Biotechnology of Lactic Starter Cultures.* Examination of genetics and microbiology of lactic starter cultures, with emphasis upon the development and application of biotechnology toward strain improvement and design. Prerequisite: NFS 411/511. (3Sp)

**Department of Physics**

535. *Topics in Physics (Topic).* Independent or group study of physics topics not covered in regular course offerings. Prerequisite: Phys 471 (may be taken concurrently). (1-6)


581, 582, 583. *Physics Colloquium.* A series of invited lectures on specialized topics in physics and related subjects. Prerequisite: Phys 374 (may be taken concurrently). (1F) (1W) (1Sp)
Department of Plants, Soils, and Biometeorology

Plant Science
610. Seed Physiology and Production. Germination, viability, and longevity of seeds; seed quality and seedling vigor; perennials; identity and maintenance; pest tolerance and control, and stress physiology and factors limiting productivity. 4 (F)
605 (S565). Crop Protection Chemicals. 8

Soil Science
613 (S313). Soil Genesis, Morphology, and Classification. Morphology, development, and classification of soils. Lectures and weekly field exercises emphasize soil as a natural body on the landscape: its evolution, behavior, and interpretation. Prerequisites: Soil 338 and 339 (recommended). 5 (Sp)
630 (S330). Soil Microbiology. Activities and ecology of microorganisms related to soil environment, soil fertility, soil organic matter, rhizosphere, and soil amendments. Prerequisites: Biol 125, Chem 141 or 231. 2 (F)
655 (S555). Soil and Plant Nutrition. Essential nutrients in plants and their forms in the soil. Chemical and biological basis of the bioavailability of nutrients to plant roots. Transformations and availability of soil amendments. Prerequisites: Soil 338 and Chem 111 or 123. 3 (W)
656 (S556). Soil and Plant Nutrition Laboratory. Soil analysis by chemical and biological procedures for assessment of nutrient availability of soils. Basic soil characteristics related to plant growth conditions. Prerequisite: Soil 655/555 prior to or concurrently. 1 (W)
672 (S672). Chemistry of Aquatic Systems. Emphasis on the chemical processes occurring in natural environments. Principles of physical chemistry applied to problems involving the composition of natural waters. Prerequisites: Chem 121, 122, and 123. 3 (Sp)

Biometeorology
625 (S525). Principles of Remote Sensing and Applications in Agriculture and Hydrology. Techniques for ground-based measurements of reflected and emitted radiation as well as ancillary data collection to support airborne and satellite remote sensing studies in agriculture and hydrology. Recommended: Introductory calculus and physics. 4 (Sp)
630 (S530). Introduction to Meteorology. Introduction to principles of meteorology for students with science background. Treatment of the nature of storms, winds, clouds, precipitation, and atmospheric circulation. Prerequisite: junior standing. 4 (W)

Department of Psychology
651. Psychological Assessment of Preschool-Age Children. Training and supervised experience in administering and interpreting cognitive, developmental, psychoeducational, and adaptive/social functioning measures with preschool-age children. Prerequisites: Psy 631, 641, and 669. 3 (F)
657 (S657). Introduction to Educational and Psychological Research. Identifying a research problem, reviewing and evaluating the research literature, designing and carrying out a research project. Research area should be identified before enrolling. Prerequisite: Psy 380. 3 (Sp,Su)
660. Descriptive and Inferential Statistics I. Introduction to General Linear Model as a basis for statistical analysis. Emphasis on correlation and regression and associated inferential procedures. Prerequisites: Psy 380, Educ/Psy 665 or Educ 665. 3 (F,W)
661. Descriptive and Inferential Statistics II. Continuation of Educ/Psy 660. General Linear Model used as a basis for statistical analysis, with emphasis on Analysis of Variance and Covariance. Prerequisite: Educ/Psy 660. 3 (W,Sp)
688. Transcultural Assessment and Diagnosis. Provides experience in transcultural issues in the evaluation of minority children with specific focus on American Indians. 1-3 (F,W,Su)
700. Research Designs in Educational and Psychological Research. Choosing research designs based on research questions, including quantitative group and single subject, correlational, and qualitative. Prerequisites: Educ/Psy 661 and Educ 677. 3 (Sp,Su)
707. Designing Educational and Psychological Research. Helps students understand research design concepts, become competent at interpreting research findings, begin studies on prior research, conducting doctoral-level seminars, critiquing research reports, and developing proposals. Prerequisite: Educ/Psy 700. 3 (F,Su)

Department of Rangeland Resources
730. Population Ecology of Plants. Dynamics of the numbers of individual plants as influenced by seed dispersal and dormancy; seedling recruitment; interspecific and intraspecific competition; sexual vs. asexual reproduction. 4 (W)

Department of Secondary Education
638. Character and Values Education. For teachers, administrators, and parents. Includes history and current programs in character and values education. Participants will develop curriculum for their schools. 2-3 (Su)

Department of Sociology, Social Work and Anthropology
Anthropology
610 (S410). The Practice and Principles of Cultural Anthropology. Reviews practice and principles of cultural anthropology, introduces major paradigms, and emphasizes critical reading and thinking skills. 3 (F)
636 (S436). Great Basin Archaeology and Past Environments. Prehistoric to historic human ecology and paleoenvironments of the Desert West. Three credits lecture, five credits lecture/two weekend field trips. 3 (Sp)
641 (S441). Shamanism and Traditional Medicine. Survey of traditional forms of healing and medical systems in anthropological context. Emphasis on discussion and application of readings to ethical and practical concerns. 3 (W)
699 (S499) (F600 (S400)). Anthropological Theory. The intellectual history of alternative theoretical perspectives in anthropology. Analysis of contemporary dilemmas, issues, and applications. Course is seminar format and team taught. 4 (W)

Department of Special Education and Rehabilitation
531. Student Teaching in Special Education: Dual Majors. Undergraduate student teaching for dual majors. 3-15 (F,W,Sp)
532. Curriculum for Students with Mild/Moderate Disabilities. Future teachers learn to analyze transition, school survival skills, and content area curricula, and develop skills to teach in these areas. Prerequisite: admission to special education major or permission of instructor. 4-5 (W)
543. Practicum: Teacher Designed Instruction. Students assess, design teaching materials, and provide daily instruction to pupils with mild or moderate disabilities. Prerequisites: SpEd 540 and 541 and admission to special education major or permission of instructor. 4-5 (W,Sp)
579. Special Topics. 1-4 (W,Su)
584. Practicum in the Least Restrictive Environment with Family Service Plans. Students will participate in a variety of environments serving preschoolers with disabilities, assist in developing a Family Service Plan, and train another adult to conduct programs. Prerequisite: admission to special education major or permission of instructor. 1-4 (W)
611 (S511) (S611). Psychoeducational Aspects of Disability. The psychological and sociological aspects of severe disabilities, including the adjustment factors in living with disabilities, knowledge of community attitudes, and strategies to change those attitudes. Students enrolled in SpEd 611 must take the final exam and complete a 15-page paper. Students enrolled in SpEd 511 must take the final exam, but are not required to complete the paper. 3 (F,W)
670. Single-Subject Research Methods and Designs. Experimental research methods employed by general and special educators, psychologists, and other related services professionals to analyze effects of instruction, treatment, and other interventions on behavior of students, clients, or other participants included in the research as individuals or members of small groups. 3 (F,Su)

New course.
New course number. Former course number, shown in parentheses, is preceded by an f.
New multiple listing. Other departmental listing is in parentheses.
New title.
Number of credits changed.
New course description.
Prerequisite listing revised.
Course no longer offered.
1995-1997

Graduate Catalog

James P. Shaver, Dean
School of Graduate Studies
Utah State University
Logan, Utah 84322-0900

Telephone (801) 797-1189
Catalog Information

Catalog information and University requirements may change at any time. USU is not bound by requirements or regulations listed in this catalog. Information may change before a new catalog is issued, and students must adhere to changes. It is the student’s obligation to ascertain current rules, regulations, fees, and requirements.

Course Descriptions

Course descriptions in this catalog are an overview and generally reflect what will be taught, but students should not rely on them as a guarantee of what they will be taught in a given quarter.

Assumption of Risk

Some classes within the University involve some risk and some may also involve travel. The University provides these classes on a voluntary basis, and students should not participate in them if they do not care to assume the risks. Students ought to inquire as to possible risks a class or major may generate, and if they are not willing to assume the risks, they should not select that class or major. By voluntarily participating in these types of activities, the student agrees not to hold USU or its staff liable.

Equal Opportunity/Affirmative Action

Utah State University is committed to providing equal educational and employment opportunity regardless of race, sex, color, religion, national origin, marital or parental status, physical or mental disability, veteran status, or age. USU also has a policy prohibiting sexual harassment of students, faculty, and staff. Equal opportunity applies to all aspects of employment: recruiting, hiring, promoting, training, benefits, and salary. Equal educational opportunities include admission, access to course offerings, financial assistance, housing, and extracurricular activities.

Privacy Rights

In compliance with the Family Educational Rights and Privacy Act of 1974, Utah State University has developed policy guidelines which (1) provide that eligible students will have access to inspect and review their educational records, and (2) protect the rights of a student to privacy by limiting access to the educational record without express written consent. Note: There are restricted situations in this act where access to an educational record does not require the express written consent of the student.

Materials for Persons with Disabilities

This catalog is available in large print, audio, and braille format upon request to the USU Disability Resource Center.
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Utah State University

Utah State University in Logan was founded in 1888 as part of the public education system of Utah and operates under the constitution and laws of the state. USU is one of the two major universities in the Utah System of Higher Education and is the state's land-grant university under state and federal legislation. Land-grant universities had their origin in 1862. The Utah institution was originally called the Agricultural College of Utah and later became Utah State Agricultural College. The state legislature approved the name change to Utah State University (USU) in 1957.

USU is a primary center of research and of graduate, professional, and undergraduate education in numerous fields of study. It has colleges of Agriculture, Business, Education, Engineering, Family Life, Natural Resources, Science, and Humanities, Arts and Social Sciences; a School of Graduate Studies; a Division of International Studies and Programs; a Division of Extension and Continuing Education, including the Cooperative Extension Service and continuing education centers in the Uintah Basin and Southeastern Utah; the Utah Agricultural Experiment Station; and the Research and Technology Park.

Utah State University ranks among the nation's top 100 universities in obtaining grant funds for research. The University cooperates with various agencies on a national and international level to promote the discovery and sharing of knowledge.

With a student body of more than 20,000, USU combines the academic advantages of a large university with the friendliness of a small college. The University is located in Logan, a city of approximately 36,000 people, surrounded by mountains, in the heart of beautiful Cache Valley. There are abundant opportunities for outdoor activities, such as skiing, fishing, and hiking; and numerous national parks, including Yellowstone and Grand Teton, are within easy driving distance.

USU is accredited by the Northwest Association of Secondary and Higher Schools and is listed by these accrediting agencies: American Assembly of Collegiate Schools of Business, National Council for Accreditation of Teacher Education, Engineering Council for Professional Development, Council of Professional Development of American Home Economics Association, Society of American Foresters, American Chemical Society, American Speech and Hearing Association Educational Training Branch, American Society of Landscape Architects, National League of Nursing Accrediting Service, American Psychological Association, Council on Social Work Education, and Utah State Board of Vocational Education. It is a member of the American Council on Education and is on the accepted list of the Association of American Universities and of the American Association of University Women.
Graduate Calendar

For information on registration and dropping and adding classes, consult the current class schedule. For degree completion dates, consult the School of Graduate Studies. All dates are subject to change without notice.

**Fall Quarter 1995**

- **September 25, 26**: New student orientation
- **September 27**: Classes begin
- **November 22-24**: Thanksgiving break
- **December 8**: Last day of classes
- **December 11-14**: Final examinations
- **December 14**: Last day to complete degree requirements for fall quarter

**Winter Quarter 1996**

- **January 3**: Classes begin
- **January 12***: Candidacy forms and thesis statement must be completed, signed, and submitted to the School of Graduate Studies. Approved supervisory committee form should be on file.
- **January 15**: Holiday (Human Rights Day)
- **March 12**: Last day of classes
- **March 13-15**: Final examinations
- **March 15**: Last day to complete degree requirements for winter quarter

**Spring Quarter 1996**

- **March 25**: Classes begin
- **April 5***: The final examination in defense of the thesis must be completed (nonthesis exams included).
- **April 12***: Committee-approved thesis must be submitted to the School of Graduate Studies for review.
- **April 12***: All graduation forms must be completed and submitted to the School of Graduate Studies along with proof of payment of all fees.
- **May 10***: Thesis must be approved by the thesis coordinator.
- **May 10***: Letter of completion from department head (nonthesis programs) must be on file in the School of Graduate Studies Office.
- **May 10***: Incomplete grades must be changed and posted on transcript.
- **May 27**: Holiday (Memorial Day)
- **May 31***: Two copies of the approved thesis must be submitted to the School of Graduate Studies for binding.
- **June 3-6**: Final examinations
- **June 7**: Master’s and Doctoral Hooding Ceremony
- **June 8**: Commencement

**Summer Quarter 1996**

- **June 10-14**: Presession
- **June 17-21**: Presession
- **June 24**: Classes begin
- **July 4**: Holiday (Independence Day)
- **July 24**: Holiday (Pioneer Day)
- **August 16**: Quarter ends
- **August 19-23**: Postsession
- **August 23**: Last day to complete degree requirements for summer quarter

*Deadlines for inclusion in the 1996 Commencement ceremonies and program.
Fall Quarter 1996
Sept. 30, Oct. 1  New student orientation
October 2      Classes begin
November 27-29 Thanksgiving break
December 13    Last day of classes
December 16-19 Final examinations
December 19    Last day to complete degree requirements for fall quarter

Winter Quarter 1997
January 6      Classes begin
January 10*    Candidacy forms and thesis statement must be completed, signed, and submitted to the School of Graduate Studies. Approved supervisory committee form should be on file.
January 20     Holiday (Human Rights Day)
March 14       Last day of classes
March 17-19    Final examinations
March 19       Last day to complete degree requirements for winter quarter

Spring Quarter 1997
March 25       Classes begin
April 4*       The final examination in defense of the thesis must be completed (nonthesis exams included).
April 11*      Committee-approved thesis must be submitted to the School of Graduate Studies for review.
April 11*      All graduation forms must be completed and submitted to the School of Graduate Studies along with proof of payment of all fees.
May 9*         Thesis must be approved by the thesis coordinator.
May 9*         Letter of completion from department head (nonthesis programs) must be on file in the School of Graduate Studies Office.
May 9*         Incomplete grades must be changed and posted on transcript.
May 26         Holiday (Memorial Day)
May 28*        Two copies of the approved thesis must be submitted to the School of Graduate Studies for binding.
June 2         Last day of classes
June 3-6       Final examinations
June 6         Master's and Doctoral Hooding Ceremony
June 7         Commencement

Summer Quarter 1997
June 9-13      Presession
June 16-20     Presession
June 23        Classes begin
July 4         Holiday (Independence Day)
July 24        Holiday (Pioneer Day)
August 15      Quarter ends
August 18-22   Postsession
August 22      Last day to complete degree requirements for summer quarter

*Deadlines for inclusion in the 1997 Commencement ceremonies and program.
Utah State Board of Regents
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Andrea Udy Opfar, Murray
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President of the University: George H. Emert

Acting Provost: A. Bruce Bishop
Acting Associate Provost: H. Craig Petersen
Assistant Provost: C. Blythe Ahlstrom

Assistant to the President for Government Relations: Lee H. Burke
Assistant to the President for Legal Affairs: Robert D. Barclay
Assistant to the President for USU Foundation: Bartell C. Jensen

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Dean, College of Business: David B. Stephens
Dean, College of Education: Izar A. Martinez
Acting Dean, College of Engineering: Alma P. Moser
Dean, College of Family Life: Bonita W. Wyse
Dean, College of Humanities, Arts and Social Sciences: Brian L. Pitcher
Dean, College of Natural Resources: Joseph A. Chapman
Dean, College of Science: James A. MacMahon
Dean, School of Graduate Studies: James P. Shaver
Assistant Vice President for Extension and Dean, Continuing Education: Rex L. Tueller
Dean of Learning Resources: Glenn R. Wilde
School of Graduate Studies

James P. Shaver
Dean, School of Graduate Studies
tel. (801) 797-1189

Graduate programs at USU are supervised by the dean of the School of Graduate Studies, assisted by the Graduate Council. The council consists of the dean, one four-year representative from each of the eight colleges of the University, one representative from the Faculty Senate, the executive director of the University library, and two graduate students. Policies and regulations for graduate work are established by the Graduate Council with the approval of the Faculty Senate.

USU has awarded master of science degrees since 1914 and doctoral degrees since 1950. The School of Graduate Studies was formally organized in 1945. Graduate degrees are offered in 41 of the University's 45 departments and through several interdepartmental programs. Included are 96 master's programs, 40 doctoral programs, and 5 other degrees. Nationally and internationally known scholars and research units participate in and support graduate studies at USU. Graduate students constitute nearly 20 percent of the University's enrollment.

Faculty members participating in graduate programs are listed at the back of this catalog. Included are academic rank, year of appointment to USU, degrees and years received, and the institutions granting the degrees.

The School of Graduate Studies holds memberships in the Council of Graduate Schools in the United States and the Western Association of Graduate Schools.

The Graduate Council

Chairman: James P. Shaver, Dean, ex officio

College of Agriculture: Thomas D. Bunch
College of Business: James W. Brackner
College of Education: K. Richard Young
College of Engineering: Ronald C. Sims
College of Family Life: Brent C. Miller
College of Humanities, Arts and Social Sciences: Anne M. Butler
College of Natural Resources: Raymond D. Dueser
College of Science: Anne J. Anderson

Senate Representative: Leona K. Hawks
Library, ex officio: Max P. Peterson
Graduate Students:
  Graduate Studies Senator
  President, Graduate Student Senate
University Research

Vice President for Research: Peter F. Gerity
Office in Main 127, 797-1180

Associate Vice President for Research: H. Paul Rasmussen
Office in Main 124, 797-1199

Research Programs

Utah Agricultural Experiment Station: Director H. Paul Rasmussen
Engineering Experiment Station: Acting Director Alma P. Moser
Utah Center for Water Resources Research: Director David S. Bowles
Utah Water Research Laboratory: Director David S. Bowles
Ecology Center: Director Frederic H. Wagner
Center for Atmospheric and Space Sciences: Director Robert W. Schunk
Utah State University Research Foundation: President and CEO Bartell C. Jensen
Center for Persons with Disabilities (CPD): Director Marvin G. Fifield
Bureau of Research Services, College of Education: Associate Dean Ron J. Thorkildsen
Institute of Political Economy: Director Randy T. Simmons
Economics Research Institute: Director Herbert H. Fullerton
Institute for Land Rehabilitation: Interim Director John C. Malechek

Research Supporting Activity

Contract and Grant Office: Director M. Kay Jeppesen

Research Committees

University Research Council: Chairman Peter F. Gerity
University Safety Committee: Chairman David B. Brown
Radiological Safety Committee: Chairman LaGrande C. Ellis
Committee on Experimental Animals: Chairman Stanley D. Allen
Committee on Human Subjects: Chairman Carol T. Windham
Institutional Biosafety (RDNA) Committee: Chairman John D. Morrey
Indirect Cost Waiver Committee: Secretary M. Kay Jeppesen
Biohazards Committee: Chairman Robert W. Sidwell
Chemical Hygiene Committee: Chairman William A. Brindley
State Arboretum at Utah State University: Mary E. Barkworth

Cooperative Research Units

Utah Cooperative Fish and Wildlife Research Unit: John A. Bissonette
USDA Forestry Sciences Laboratory: Raymond W. Brown

USU was among the first of the colleges and universities in the intermountain area to have a research program. Originally research was principally in agriculture. Now research projects are in every college and almost every department of the University.

Research is closely associated with teaching and student activities. Most research is conducted by staff members who also teach.

Many graduate and undergraduate students are employed to assist in research. The experience thus gained by students is an important part of their education.

Research affiliated with the University is under the general administration of the Vice President for Research. Actual research operations are conducted in colleges and departments and within the research units designated above.

Research stipends are available for many graduate students within the several colleges and research units. Opportunities exist for multidisciplinary programs through such units as the Ecology Center, the Center for Atmospheric and Space Sciences, the Utah Agricultural Experiment Station, the Institute for Land Rehabilitation, the Center for Biotechnology, and the Center for Water Resources Research. There are numerous well-equipped laboratories such as the Utah Water Research Laboratory, the Space Dynamics Laboratory, the Center for Persons with Disabilities, the many facilities of the Utah Agricultural Experiment Station, and in Biology and Natural Resources.

Policies on research and requests for support are reviewed by the University Research Council. Present members of the council and the area each represents are: Peter F. Gerity, chairman; A. Bruce Bishop, Acting Provost; M. K. Jeppesen, Contract and Grant Office; Robert W. Schunk, Center for Atmospheric and Space Sciences; Rodney J. Brown, Agriculture; David B. Stephens, Business; Ron J. Thorkildsen, Bureau of Research Services; Izar A. Martinez, Education; Alma P. Moser, Engineering; Bonita W. Wyse, Family Life; Brian L. Pitcher, Humanities, Arts and Social Sciences; Joseph A. Chapman, Natu-
rural Resources: James A. MacMahon, Science; James P. Shaver, School of Graduate Studies; H. Paul Rasmussen, Utah Agricultural Experiment Station; David S. Bowles, Utah Water Research Laboratory; Allan J. Steed, Space Dynamics Laboratory; Frederic H. Wagner, Ecology Center; Marvin G. Fifiold, Center for Persons with Disabilities; Dennis L. Welker, Faculty Senate; and two student members.

Division of University Research
Vice President for Research: Peter F. Gerity
Office in Main 127

The policy of the University is to encourage and support research and all forms of creative, scholarly activities by staff members. Much of the research is supported by funds directly assigned to various administrative units of the University. Unrestricted funds for general support of research are administered through the Division of Research.

The Division of Research serves as a coordinating center for all research associated with the University. General policies and procedures pertaining to research and the promotion of a coordinated research program are the responsibility of the University Research Council.

Agricultural Experiment Station
Director: H. Paul Rasmussen
Office in Agricultural Science 225

The Agricultural Experiment Station, a major division of the University, was established in 1888 when the territorial legislature passed a bill creating Utah Agricultural College and Utah Agricultural Experiment Station. It is commissioned by state and federal legislative acts to conduct the research needed to conserve and manage natural resources; to produce, prepare, and market food and fiber; and to develop and improve rural living.

The Experiment Station fulfills its responsibilities with over 130 full- or part-time professional staff members located in 14 departments of the University. The staff includes about 35 employees of the U.S. Department of Agriculture who collaborate in agricultural research activities. A large number of undergraduate and graduate students are employed on a part-time basis to assist with the research.

The Experiment Station investigations include over 200 research projects, ranging from applied field tests to fundamental research under controlled laboratory conditions.

Experiment Station research is periodically reviewed by advisory committees representing all of the agricultural industries. These committees evaluate the research progress and recommend areas for further study.

Most of the research facilities of the Experiment Station are on the USU campus, distributed in various University buildings. In addition the Experiment Station operates other farms and associated research facilities distributed throughout the state. Field tests and studies of industries and communities are conducted on a short-term basis at more than 100 other locations each year.

Engineering Experiment Station
Acting Director: Alma P. Moser
Office in Engineering C 110B

The Engineering Experiment Station, as part of the College of Engineering, has the broad purpose of furthering engineering sciences; engineering research, design, and development; and engineering education. The station was established in 1918 and is financed by mineral lease funds and federal, state, and industrial grants.

The director of the Engineering Experiment Station, the engineering department heads, and the individual faculty members share the responsibility to develop engineering research programs to advance knowledge and to serve the needs of the state and the nation. Interdisciplinary programs are encouraged. Financial support and professional training for graduate and undergraduate students are provided in the research programs.

Faculty members with similar and complementary talents have organized into working groups which appropriately identify their areas of research. The mutual stimulation and organizational visibility thus achieved aids in mounting effective attacks on engineering problems encountered by the state and nation. Some of the recent areas of research in the Engineering Experiment Station include irrigation and water management, toxic and hazardous wastes management, solid waste compression, risk assessment, transportation, structural systems, geotechnical analysis and buried structures, CAD/CAM, robotics and automation, thermal and cryogenic systems, image processing and compression, computer networking, parallel computing, neural networks, and virtual reality.

Utah Center for Water Resources Research (UCWRR)

Director: David S. Bowles
Associate Director: R. Ryan Dupont
Office in Utah Water Research Laboratory

Purposes of the Utah Center for Water Resources Research are to (1) foster interdepartmental research and educational programs in water resources, (2) administer the State Water Research Institute Program funded through the U.S. Geological Survey at USU for the State of Utah, and (3) provide University-wide coordination of water resources research.

The governing body for the Utah Center for Water Resources Research is a council composed of the deans of the Colleges of Agriculture, Engineering, Natural Resources, Science, and Humanities, Arts and Social Sciences; directors of the Utah Agricultural Experiment Station, Utah Water Research Laboratory, and Ecology Center; and vice president for research.

To foster interaction of the water research programs at USU with state needs, a Citizen Advisory Council for Water Resources Research has been established. The council has representatives from various economic sectors, water professionals, and administrative policy-makers. The Citizen Advisory Council serves both the UWRL and the UCWRR.

All University faculty engaged in water resources edu-
cation or research are considered associates of the center. The center promotes and coordinates the development of research and instructional programs that will further the training of water resource scientists and engineers. It maintains liaison relationships with appropriate state, national, and international organizations and agencies having similar objectives.

**Utah Water Research Laboratory (UWRL)**

**Director:** David S. Bowles  
**Associate Director:** R. Ryan DuPont  
**Administrative Associate Director:** Steven H. Iverson

The Utah Water Research Laboratory houses one of the finest facilities in the country for research in groundwater, hydraulics, environmental engineering, hazardous waste management, water resources, and hydrology. Campus-wide interactions give all of these programs a strong interdisciplinary flavor that few other programs can match. The building provides more than 102,000 square feet of research space that is intensively used for a wide variety of studies. The faculty, students, and technical support personnel connected formally or informally with the laboratory (totaling approximately 200 individuals working on over 150 projects during the 1994 fiscal year) provide and train a breadth and depth of expertise important for water resources management in the state, nation, and world.

**Facilities.** The hydraulic testing utilizes flows up to 180 cfs on model studies served by a variety of flumes, channels, pumps, pipelines, weighing tanks, and supporting instrumentation. Environmental research is served by gas chromatographs, high pressure liquid chromatographs, a gas chromatograph/mass spectrophotometer, an ion chromatograph, liquid scintillation counters, an atomic absorption spectrophotometer, an inductively coupled plasma emission spectrophotometer, and microscopy, bioassay, Ames test, and toxicity testing capabilities.

**Program and Staff.** The laboratory serves as a research arm to state and local agencies with water and environmental problems, and it conducts research on a wide variety of topics affecting agricultural, municipal, industrial, and recreational users of water. Both basic and applied research are joined in practical problem solving. A diversified staff of internationally recognized experts conducts multidisciplinary studies in surface and groundwater management. The expert teams draw from engineering, chemistry, biology, meteorology, sociology, economics, political science, forestry, fisheries, and other fields. The research program addresses hazardous waste management, groundwater development, water supply and systems operation optimization, water resources planning at the river basin scale, cavitation, flow transients, hydraulic structure design, use of satellite data in hydrologic analysis, risk-benefit assessment, dam safety, effects of climate change, and water education in public schools.

**Academic and Research Liaison.** The Utah Water Research Laboratory and the Utah Center for Water Resources Research have the same Citizen Advisory Council. Research at UWRL is closely linked to academic programs through graduate research and joint appointments for professorial staff who have teaching assignments in academic departments.

UWRL assistance helps students financially and academically. The “tutorial” relationship between student and professor develops experience in research methods and introduces fresh new ideas about real world problems into the formal training programs of water scientists and engineers. During the 1994 fiscal year, approximately 80 graduate students received research assistantships and made important contributions to the science and practice of water resources and environmental quality management.

**Center for Atmospheric and Space Sciences**

**Director:** Robert W. Schunk  
**Office in SER 246**  
**Dean of Science:** James A. MacMahon

The Center for Atmospheric and Space Sciences is recognized both nationally and internationally for its research programs. Through this interdisciplinary center, research is conducted by faculty and student teams in many widely varied areas of atmospheric and space sciences and associated disciplines.

The capabilities and strengths of the USU atmospheric and space research program have been repeatedly demonstrated through the completion of many successful research programs. Since 1970, USU has launched more than 90 rocket-borne payloads, more than eight high-altitude balloon-borne payloads, and participated in many aircraft-borne research programs. The instrumentation included on these vehicles has ranged from simple experiments aboard small meteorological-type vehicles to large, complex, recoverable payloads designed expressly for comprehensive studies of atmospheric and ionospheric parameters. In addition, various individuals have participated in ESA and NASA spacecraft programs. Ground-based research includes the Bear Lake Observatory operated by USU and experiments at most of the U.S. chain of incoherent-scatter radars (Sondrestrom, Millstone Hill, Arecebo, Jicamarca). Also, studies of low-latitude ionospheric electrodynamics using incoherent scatter radars, satellites, and Fabry-Perot measurements have been conducted. An extensive theoretical/modeling program is currently active in CASS. Large-scale three-dimensional numerical models have been developed to describe the ionosphere, the atmosphere, the plasmasphere, and the polar wind. Space contamination models describing the environment around space vehicles have been developed. In addition, particle-in-cell (PIC) simulation codes are being used to study plasma expansion processes, contact potentials, electron-beam plasma interactions, shocks, nonlinear wave-particle and wave-wave coupling, and several auroral plasma physics problems.

Undergraduate and graduate students are currently involved in numerous research projects in CASS that provide opportunities to program computers, analyze data, and build instrumentation. Students are encouraged to actively participate in solving research-related problems, where they can receive valuable exposure to scientific programs as well as “hands-on” experience in research while they pursue degrees. Research assistantships are available to both undergraduate and graduate students (PhD and master’s level) under the direction of faculty members associated with the center. The degrees are awarded by the associated departments, including: Chemistry and Biochemistry, Electrical and Computer Engineering, Physics, and Plants, Soils, and Biometeorology.
Utah State University Research Foundation
Chairman of the Board of Trustees: Glenn Mecham
President and CEO: Bartell C. Jensen
Vice President: Deran J. Baker
Vice President: M. Kay Jeppesen

dba Space Dynamics Laboratory
Division Directors of the Space Dynamics Laboratory:
Systems Division: Allan J. Steed
Science Division: James C. Ulwick
Computational Sciences Division: J. Steven Hansen

Utah State University's Space Dynamics Laboratory is recognized as one of the nation's unique and vital resources in space research, conducting programs which are primarily directed toward increasing mankind's understanding of the nature of earth and space. These programs present faculty and students with unparalleled opportunities for exciting, intellectual, and hands-on engineering and science challenges in state-of-the-art space research in conjunction with their academic work.

Areas of expertise at the Space Dynamics Laboratory include conception and design of cryogenically-cooled infrared sensors; engineering of active and passive instrumentation systems for operation aboard rockets, satellites, and aircraft; calibration of space sensors; modeling of the dynamics of the planetary atmospheres; measurement of outer space phenomena; processing and analysis of spectrally- and spatially-imaged, remotely-sensed data; and cooperative around-the-globe observation programs with visiting faculty/student scientific teams at remote sites and at USU's Bear Lake Observatory.

The Computational Science Division (CSD) was established to create a center for large scale data processing and performance analysis for one of SDL's space-based sensors. CSD has since expanded its expertise into the areas of sensor simulation, image processing, data visualization and animation, high-speed scalable hardware configuration, database technology, and other areas requiring complex computer control. By seeking opportunities to address the growing need for innovative data analysis solutions, CSD hopes to meet and go beyond the state of the art in scientific computing.

The Laboratory has been very successful in generating undergraduate and graduate assistantships and in cooperative exchanges with industry, government, and educational institutions.

dba Technical Resources Laboratory
Director: Gene L. Mortensen

The Technical Resources Laboratory was created to promote Utah State University as an educational and research center. Through the auspices of the laboratory, the faculty, staff, and students of Utah State University have the opportunity of extending their educational and research expertise to serve as facilitator to private enterprise, government, and the community. Its unique relationship with Utah State University allows it to use facilities, equipment, and personnel to enter into and administer special contracts for research, educational programs, and technical and scientific services.

The laboratory assists individuals and groups at Utah State University in the development and expansion of research, instructional, and service programs supplemental to, and integrated with, the present activities of the University. It provides an outlet for faculty consulting and an opportunity for graduate and undergraduate student interface with other universities, governmental agencies, and private industry.

Areas of emphasis include testing and modeling, environmental feasibility and assessment studies, surveys, equipment and facility leasing, product development, manufacturing, marketing, and contracting for services.

dba Utah Research Institute
Director: David G. Norton

Utah Research Institute (URI) is chartered as a non-profit consortium of Utah's four major institutions of higher learning. URI identifies and mobilizes resources and implements cooperative efforts among institutions to solve technical problems for industry.

Center for Persons with Disabilities
Director: Marvin G. Fifield
Office in Center for Persons with Disabilities 120

The Utah State University affiliated Center for Persons with Disabilities (CPD) is one of approximately 60 such centers located in major universities throughout the United States. The mission of the CPD is to improve the quality of life of persons with disabilities by (1) providing interdisciplinary training to personnel needed to provide the broad spectrum of services for individuals with disabilities; (2) demonstrating exemplary service and delivery systems in rural and remote areas; (3) conducting research projects which will provide additional knowledge and application of materials, strategies, and techniques for people with developmental disabilities; and (4) providing technical assistance and training to the various service agencies to expand and improve the quality of service that they provide.

The CPD is located on the University campus in a facility constructed specifically for the program. Various training and service activities are undertaken not only on campus, but in several affiliated service centers in Utah, the Navajo Reservation, and other community-based sites throughout the nation.

The faculty and staff of the CPD consist of specialists from a variety of disciplines, including special education, psychology, social work, medicine, instructional technology, early education, and vocational rehabilitation. Students come to the center from a variety of University academic departments, and the center provides supplemental coursework, research, practicum, internship, and research assistantships to prepare students to better meet the needs of individuals with disabilities.

The center reports through the College of Education and is governed by a Board of Directors appointed by the University President. The program is organized into seven divisions: Exemplary Services, Interdisciplinary Training, Outreach and Development, Biomedical Research and Service, Research and Evaluation, Technical
Assistance, and Technology. The center employs approximately 240 professionals and classified employees in its many training, research, and service projects. People with disabilities (infants through adults) are served directly through home and community-based day-service programs, and training is provided to more than 1,000 University students each year. Over 3,000 employees of service agencies in the state and region receive in-service training through workshops and seminars provided by the CPD each year.

Major research activities include: (1) the application of technology to improve service programs; (2) early intervention research for preschool and at-risk children; (3) the effects of the immune system on Down Syndrome and autism; (4) development of staff training programs utilizing videodiscs, CD ROMs, and distance-learning technology; and (5) design and development of assistive technology devices and services.

Bureau of Research Services, College of Education
Chairman: Ron J. Thorkildsen
Office in Emma Eccles Jones Education 453

The College of Education's Bureau of Research Services (1) provides research assistance to faculty and graduate students in the College of Education, (2) assists faculty and students in locating off-campus funding for projects, (3) assists faculty and students in preparing research and other program proposals, (4) advises the dean and departments on research matters, and (5) represents the college on the University Research Council and on other research-related committees.

Institute of Political Economy
Director: Randy T. Simmons
Administrative Director: Roberta Q. Herzberg
Office in Main 342F

The purpose of the Institute of Political Economy at Utah State University is to promote a greater understanding of the foundations of a free society. Most of the funding is from private individuals, corporations, and foundations.

The activities are organized around three main programs—the environmental program, the health care program, and the philosophy program. The environmental program is based on the belief that property rights and targeted liability are far more effective than standard government command and control programs. Under the health care program, the Institute is organizing research programs to study health care policy and innovative programs in Utah. The Institute is also greatly involved in the public education process for health care reform. The philosophy program develops the moral and ethical considerations behind free people and free markets.

The Institute was listed on the Templeton Foundation's honor roll for 1989, as one of only three noteworthy, University-based programs.

Economics Research Institute
Director: Herbert H. Fullerton
Office in Business 504

The Economics Research Institute promotes and coordinates research on economic and related problems. The institute serves as a clearinghouse for ideas and methods related to research. Seminars and conferences stimulate faculty and student interest. Members of the Department of Economics and others who work in affiliated areas coordinate their work through the institute and receive assistance in planning research and in seeking financial support from agencies interested in their areas of research. A research study papers series is produced by the institute reporting on research, conferences, and seminars sponsored by the institute.

Ecology Center
Director: Frederic H. Wagner
Office in Natural Resources 314C

The function of the Ecology Center is to promote and coordinate research and graduate study in the science of ecology, and to provide professional ecological advice to decision makers. Its participating faculty members hold tenure in the Colleges of Agriculture, Natural Resources, and Science, and the Departments of Biology; Fisheries and Wildlife; Forest Resources; Geography and Earth Resources; Geology; Plants, Soils, and Biometeorology; and Rangeland Resources.

Development of the Ecology Center recognizes that ecology is a multidisciplinary field, requiring the coordination of biological and physical sciences. The objectives of the center are to (1) promote and support ecological research; (2) coordinate course instruction and graduate education in ecology; (3) provide an interdisciplinary focus for graduate majors in ecology; and (4) provide information and professional ecological advice for decision makers in areas affecting the environment.

About 70 faculty members actively associate with the center by participating in some aspect of ecological research or training. Although research and instruction take place in a number of states and foreign countries, the northern third of Utah provides the proximal outdoor laboratory. This includes such facilities as the Bear Lake Biological Laboratory, the USU School Forest and its supporting facilities, the Green Canyon Ecology Station, the Logan River Biology Laboratories, and the Snowville Ecology Station. It embraces a wide variety of habitat types ranging from the alpine zone to salt desert, and both aquatic and terrestrial systems.

Utah Cooperative
Fish and Wildlife Research Unit
Leader: John A. Bassonette
Assistant Leader Wildlife: Thomas C. Edwards, Jr.
Assistant Leader Fisheries: David A. Beauchamp
Office in Natural Resources 115

The Utah Cooperative Wildlife Research Unit was initiated in 1935 through a memorandum of understanding among the University, Utah Division of Wildlife Resources, Wildlife Management Institute, and the U.S. Fish and Wildlife Service and was one of the first ten wildlife units established in the U.S. The Utah Cooperative Fishery Research Unit was established at USU in December of 1961, the first of 25 such units in the United
States. In December of 1984, the two units were combined through a memorandum of understanding among all cooperators. In November 1993, the unit became part of the U.S. National Biological Survey, which became the U.S. National Biological Service in January 1995. A coordinating committee, composed of representatives from the Department of Fisheries and Wildlife, U.S. National Biological Service, the Wildlife Management Institute, and Utah State Division of Wildlife Resources, provides general guidance on the research program.

The unit's objectives are to (1) conduct research basic to proper utilization of fish and wildlife resources; (2) educate graduate students in fish and wildlife ecology and management; (3) promote fish and wildlife education through demonstration, lecture, and publication; and (4) make results of investigations available to cooperators and the public by way of peer reviewed publications, reports, popular articles, and workshops.

At the present time the fishery research program emphasis is on (1) responses of fish populations to alterations of the aquatic environment, (2) behavior and habitat requirements of fish and aquatic invertebrates, (3) genetic studies of fish populations, and (4) threatened and endangered species.

Wildlife emphasis is in wildlife management; conservation biology; landscape ecology; responses of vertebrate populations to environmental perturbation; habitat requirements of nongame and threatened and endangered species; and conservation education. In addition to the regular cooperators, funding is obtained from other state conservation agencies, as well as from U.S. government bureaus and departments.

Institute for Land Rehabilitation

Interim Director: John C. Malechok
Office in Natural Resources 210

The Institute for Land Rehabilitation (ILR) promotes education, research, and regional and campus-wide communication on land rehabilitation and restoration problems. The scope of the Institute includes watershed restoration and management, wetland and riparian area management, postburning rehabilitation, mined land reclamation, and other land restoration and rehabilitation activities.

The ILR works to increase interest in land restoration and rehabilitation concerns and research by University faculty and to promote the ILR as an information source to agency personnel and consultants throughout the West. To further achieve its objectives, the ILR sponsors and co-sponsors workshops, symposia, and shortcourses with regional participation.

The ILR resides in the Department of Rangeland Resources, College of Natural Resources.

USDA Forestry Sciences Laboratory

Office in Forestry Sciences Laboratory

The Forestry Sciences Laboratory is a research branch of the USDA Forest Service. At Utah State University, it is comprised of a Reclamation of Disturbed Lands Research Unit, a Mountain Pine Beetle Population Dynamics Research Unit, a Statistical Aspects of Monitoring Research Unit, personnel attached to the Forest Service Washington Office, and graduate students. A support unit containing a business manager and clerical personnel is housed at the laboratory to handle all of the business management activities.

General objectives at the laboratory are to perform research relevant to disturbed land reclamation, erosion and water quality, plant/environmental relationships, detection of ecosystem changes, and mountain pine beetle population dynamics. Specific research includes studies in hydrology, plant physiology, forest pest dynamics, cumulative watershed effects, ecological succession, revegetation, and soil and water chemistry. In addition, research includes estimation of plant, animal, and human diversity and density; study design; and power analyses.

The professional fields represented at the laboratory at Utah State University include plant physiologists, entomologists, ecologists, hydrologists, mathematical statisticians, and soil scientists.

State Arboretum at Utah State University

In 1961 the Utah State Legislature officially designated Utah State University as a state arboretum. The arboretum covers the entire campus and contains more than 3,000 trees. The arboretum also contains a collection of native and adapted plants located north of Old Main Hill and a native plant demonstration garden between the wings of the Edith Bowen Laboratory School. Various shrub species and colorful displays of bulbs, annuals, and perennials provide additional beauty as well as interest to the campus.

The campus arboretum is maintained by the Landscape Operations and Maintenance Department in cooperation with Campus Planning and Engineering. The tree removal policy states that when removals occur, trees shall be replaced on at least a one-to-one ratio to maintain the integrity of the campus forest. When a tree is removed from an established landscape area, the same species of tree shall be replanted at the removal site whenever possible to preserve the original design intent. When replacement on the same site is unfeasible, a replacement tree will be planted at another suitable campus location.

The USU campus serves as an educational resource for teaching programs of the University and the community at large. Students studying biology, horticulture, agronomy, forestry, and landscape architecture utilize the arboretum year-round to further develop a knowledge and appreciation for plants in the landscape.

Institute for Social Science Research on Natural Resources

Leader: Richard S. Kramlich
Office in Main 2160

The Institute for Social Science Research on Natural Resources is a research unit established to facilitate and promote faculty and student research on a wide variety of social science research topics pertaining to the interrelations between human social systems and natural resource systems. Examples of recent and ongoing projects involving affiliated faculty and student researchers include studies of the social impacts of large-scale energy re-
source developments; social and cultural consequences of nuclear and hazardous waste storage; community responses to a transfer of water resources from agricultural to industrial use; social factors influencing earthquake preparedness and response; social impacts of severe sustained drought; public perceptions and attitudes toward wildlife resources; and aquatic resource education needs. Although the institute is housed within the Department of Sociology, Social Work and Anthropology, its goal is to encourage multidisciplinary research on human aspects of natural resource issues involving faculty and students from across the University.

**Biotechnology Center**

**Director:** William H. Scouten  
**Office in Biotechnology 105**

The Biotechnology Center, created in 1986 as a Center of Excellence for the State of Utah, is a multidisciplinary unit of the Utah Agricultural Experiment Station. Its role is to support the development of biotechnology in teaching, research, and technology development and transfer. Center programs include Education and Outreach, service laboratories for biotechnology research, and support for research in agriculture, food processing and safety, animal genetics, and the environment.

Education and Outreach programs provide training and technical information to researchers, extension agents, high school teachers, government agencies, and the general public. Workshops are conducted for training in research techniques and teaching methods. Technical bulletins keep researchers abreast of new techniques and advances in biotechnology. The center offers four laboratory-intensive courses for undergraduate and graduate students. These are Methods in Biotechnology; Basic Methods, Cell Culture; Molecular Cloning; and Protein Purification.

Service laboratories provide essential biotechnology services, including DNA synthesis and sequencing, protein sequencing, peptide synthesis, monoclonal and polyclonal antibody production, immunoassay development, mammalian cell repository, fermentation, and databases for analyses.

The center also supports programs for faculty. These include grants for innovative biotechnology research projects, funding for new biotechnology faculty positions, molecular biology fellowships, and seminars.

The Biotechnology Building houses the center and research laboratories. The research laboratories are staffed by faculty and their students who are performing biotechnology research. The faculty have their academic appointments in any of the various University departments.

**Learning Resources Program**

The Learning Resources Program is a strategic academic service organization, whose purpose is to enhance the teaching, research, and service missions of Utah State University. In partnership with academic departments and colleges, research and service units, and administrative divisions, the Learning Resources Program facilitates the University Mission through four central functions: (1) Creating and maintaining core resources, including Library and Information Services, Computing Services, Media Services, and Telecommunications; (2) Facilitating and contributing to the development of educational programs and information systems to promote and extend active learning; (3) Establishing global access to informational, educational, research, and management resources; and (4) Providing and maintaining a University-wide Information Network to deliver voice, data, and video services in support of instruction, research, and extension to classrooms, laboratories, and off-campus facilities.

**Administration**

**Dean, Learning Resources Program:**  
Glenn R. Wilde, 797-1201

**Associate Dean for Extension:**  
Byron R. Burnham, 797-1637

**Budget:** Jeannie F. Simmonds, 797-3166  
**Special Projects:** Peggy P. Nixon, 797-1134

**Library and Information Services**

**Director:** Max P. Peterson, 797-2631  
**Information Systems:** Michelle M. Smith, 797-3977

**Divisions**

**Public and Technical Services:**  
Robert G. Murdoch, 797-2631  
Reference Services  
Circulation Services  
Government Documents  
Cataloging  
Acquisitions  
Serials and Binding

**Special Collections and Archives:**  
A. J. Simmonds, 797-2661  
Manuscripts  
Archives  
Rare Books and Printed Matter  
Fife Folklore Archive

**Media Services:** LaDell C. Hoth, 797-2660  
Media Distribution Services  
Media Collection Development  
Equipment Services
An extensive collection of books, periodicals, and electronic resources are represented in the library's collections. The library has been designated as a regional depository for federal documents, resulting in one of the outstanding collections in the Intermountain West. A diverse collection of local, state, and international documents is also available. Further, the library holds many specialized bibliographies, indexes, indexing and abstracting services, and subscription services crucial to the location of needed materials.

Trained library personnel specializing in reference and documents are available to provide assistance. Through the Interlibrary Services Department, library patrons can access the collections of libraries in this country and around the world. The library is a member of the Bibliographic Center for Research, the Center of Research Libraries, and the Utah College Library Consortium. The Division of Special Collections and Archives contains a significant body of primary source material (manuscripts and rare books) for area studies and for all aspects of the University's history.

**Multimedia and Distance Learning Services**

*Director*: Robb Russon, 797-2655  
*Chief Engineer, Audio and Video Engineering*:  
  Rickey D. Hughes, 797-2706  
*Manager, Television Services*:  
  Kenneth E. Boutwell, 797-3139

Provides support to the faculty and the University through the production of various types of distance learning instructional and informational video programs. Teleconferencing and satellite up-linking and down-linking of programs are available to enhance the educational experience, as well as instructional design consultation and complete electronic graphics support, including FACT (the Faculty Assistance Center for Teaching).

**Publication Design and Production**

*Head, Printing and Operations*:  
  Dale P. Smith, 797-2626  
*Head, Copy Centers*: Remani Rajagopal, 797-2620

As the publication arm of the Learning Resources Program, Publication Design and Production provides the campus community with expertise and service in all printing and publication areas. Duplication services are provided through six on-campus copy centers and graphics laboratories. A full-service printing operation is available for creation of printed University publications.

**Photography Service**

*Manager*: Arlen L. "Ted" Hansen, 797-2262

Provides support to the faculty and the University through the availability of photographers, the production of photographic prints and slides, consultation, and specialized photographic services for research and instruction.

**Computer Services**

*Director*: Karl A. Fugal, 797-2412  
*Manager of Technical Services*:  
  Kim A. Marshall, 797-2413  
*Office in SER 325, 797-2391*

The Office of Computer Services provides computing/networking facilities and services for teaching, research, library automation, and administrative uses. The centralized equipment provided for use by students, faculty, and staff includes an IBM ES9000 series system, a VMS Cluster of three DEC 3000/400 RISC Alphas, a MicroVAX III, an IBM RS6000/550 numeric intensive computer, and associated peripheral devices including a CalComp 1043GT eight pen plotter. More than 460 microcomputers located in 14 public labs are dedicated for student use. An open access lab, consisting of 20 high-resolution graphics RISC workstations, is also available to students in SER 108.

Computer Services maintains network connections to major national and international networks. These facilities provide super-computer access, data transfer, and electronic mail service to and from nearly every university and college in the free world. An intra-campus fiber optic data communications backbone is maintained and operated by Computer Services. Nearly all campus computers are connected via this facility.

A Computer Services staff of 32 permanent and 60 part-time (student) employees serves diverse user needs. Computer Services offers data entry, as well as plotting and scanning services. Canned computer programs for statistical data analyses, e.g., SAS, SPSS, MINITAB, and mathematical subroutines such as IMSL, are maintained and user consultation is available.

Computer Services periodically offers short courses on computer related skills—computer programming, using canned programs, and using peripheral equipment.

User guides and newsletters are published. All students are entitled to a computer account which is sufficient for meeting their yearly educational computing needs. Students pay a part of the costs to support academic computing through a fee collected at registration time.

**Telecommunications and Telephone Services**

*Director*: Scott N. Bradley, 797-0022  
*Assistant Director for Technical Services*:  
  Scott D. Wells, 797-3336  
*Assistant Director for Business Operations*:  
  Delia Weeder, 797-0071

Telecommunications and Telephone Services supports the educational and research programs of the University through high quality, cost-effective telephone services, including equipment, line facilities, and access to local and long distance calling networks.
University Extension

Vice President: Robert L. Gilliland
Office in Agricultural Science 221, 797-2201

Associate Vice President for Extension: Gerald R. Olson
Assistant Vice President and Dean for Continuing Education: Rex L. Tueller

Office in Eccles Conference Center 101B, 797-1691

USU Extension includes two main components: Cooperative Extension Service and Continuing Education, along with Conferencing and Institutes programs.

The Cooperative Extension Service is a unique achievement in American education. It is an agency for change, a catalyst for individual and group action. Cooperative Extension is a vast partnership made up of local residents, the state land-grant university, the U.S. Department of Agriculture, and county governments. These groups share in planning, financing, and operating Extension programs.

Cooperative Extension's job is informal education. The service transmits practical information, produced by research centers and universities, to the public throughout the state. Extension’s aim is to help people identify and solve problems in agriculture, home economics, youth, and community development. Staff members include extension agents located throughout the state and extension specialists assigned to departments on campus.

Continuing Education Programs include the Conference and Institute Division, the Class Division, the Management Institute, Independent Study, Evening School, the off-campus centers, and Com-Net, USU’s classroom telecommunication system.

Through its Extension Class Division, University Extension offers numerous undergraduate and graduate courses in selected centers throughout the state. These permit students to pursue certain degree programs. USU is affiliated with the National University Continuing Education Association.

District offices at Salt Lake, Provo, and Richfield; off-campus centers at Roosevelt, Vernal, Moab, Brigham City, Ogden, Tooele, and Richfield; and county offices in all the counties except Daggett are centers of service. Students may obtain catalogs, class schedules, graduate forms, and other information at these offices.

International Programs and Studies

Director, International Programs and Studies: Morris D. Whitaker
Associate Director: Yun Kim
Office in Military Science 216, 797-1840

Directors, International Irrigation Center: Edwin C. (Ted) Olsen and Humberto L. Yap-Salinas
Director, College of Agriculture: Weldon S. Sleight
Director, Institute for International Rural and Community Development: Brad W. Parlin
Director, Center for International Studies: Yun Kim
Coordinator, College of Business: Gary B. Hansen
Coordinator, College of Education: Gary L. Carlston
Coordinators, College of Engineering: Alma P. Moser (Acting Dean), Wynn R. Walker, Trevor C. Hughes
Coordinator, College of Family Life: Paul A. Savello
Coordinators, College of Humanities, Arts and Social Sciences: Yun Kim, Pamela J. Riley (coordinator for Women in Development)
Coordinators, College of Natural Resources: Charles W. Gay, Brien E. (Ben) Norton, Derrick J. Thom
Coordinator, College of Science: Scott R. Cannon
Coordinator, Merrill Library and Learning Resources Program: Kenneth E. Boutwell
Coordinator, University Extension: Weldon S. Sleight

Utah State University is one of the institutions of the federal system of land grant colleges in the United States. Much of its experience and development has made it a leader in the areas associated with arid and irrigated agriculture, forestry, range, plant, and animal science.

The University is recognized for its expertise, both nationally and internationally. In addition to its functions of teaching, research, and dissemination of information, staff members have been and are presently involved as consultants to private industry, land development corporations, fertilizer companies, private consulting firms, government agencies, and research groups, both at home and abroad.

Utah State University has a history of involvement in international programs dating back to the early 1930s. University personnel have worked in development programs in many of the developing nations of the world. In recent years Utah State University has worked in Bangladesh, Bolivia, Brazil, Cameroon, Cape Verde, Colombia, Ecuador, Egypt, El Salvador, Gambia, Honduras, Iran, Kenya, Morocco, Peru, Senegal, Somalia, Sudan, Tanzania, Upper Volta, and Venezuela. Current involvement includes: Armenia, Bolivia, China, Ecuador, Egypt, Iceland, India, Mexico, Morocco, Pakistan, Russia, and Senegal.
USAID/USU/IAV University Development Linkages Grant
Coordinator: Derrick J. Thom

In 1992, USU was awarded a five-year grant by the U.S. Agency for International Development (AID) to conduct collaborative activities with the Institute for Agriculture and Veterinary Science (IAV) in Morocco. This project supports faculty and student exchange under nine different activities. The College of Natural Resources at USU is administering this project with Gregory Perrier as the Campus Coordinator. The Colleges of Agriculture, Engineering, and Humanities, Arts and Social Sciences are also involved, under the direction of Weldon Sleight, Wynn Walker, and David Rogers, respectively.

U.S. Department of Education FIPSE Grant College of Natural Resources Study Abroad Program Coordinator: Derrick J. Thom

The College of Natural Resources (CNR) has a study abroad program for its undergraduate students. The participating students do coursework and field work in either Mexico, Morocco, or Morocco during a six-month to one-year study abroad experience. No graduate-level study abroad positions are currently available.

World Bank/USU/Morocco National Rangeland Development Strategy Coordinator: Derrick J. Thom

USU, in collaboration with Hassan II University, has a World Bank-supported contract with the Ministry of Agriculture in Agrarian Reform in Morocco to develop a national rangeland development strategy. Seven faculty members in the College of Natural Resources are working with their colleagues at Hassan II University to implement this fifteen-month project.

USAID/USU/Egypt Software Development for Main Irrigation Systems Management Coordinator: Wynn R. Walker

The Biological and Irrigation Engineering Department is currently under contract with USAID to develop, adapt, and verify computer software for the operation and management of the irrigation distribution system in the Nile River Valley of Egypt.

USAID/USU/India Rajasthan Agricultural University Project Coordinator: James H. Thomas

Utah State University, as lead university for the Consortium for International Development, has been selected by the World Bank and the government of India to provide a strategic development plan for Rajasthan Agricultural University. Faculty from USU and other CID universities will examine and evaluate the current organization and will make recommendations for the revitalization of this university.

USAID/FAO/USU Foreign Participant Training Coordinator: Lucy Ann Thompson

USU cooperates with FAO and USAID, as well as with other sponsoring agencies, to develop special academic and practical programs for foreign students nominated by these agencies.

For those foreign students who come to Utah State University under auspices of a sponsoring agency requiring Utah State University to provide administrative arrangements not provided to other students, an administrative fee is charged (currently $175 per quarter).

USAID/USU Rangeland Research for Increasing Small Ruminant Production (Bolivia—SR-CRSP) Coordinator: Brien E. Norton

The purpose of this project is rangeland research and training to increase productivity of llama and goats and build scientific capabilities of researchers in developing countries (Bolivia).

USDA/USU/Armenia Project Coordinator: Weldon S. Sleight

The College of Agriculture and USU Extension Services are involved in short-term consulting in agriculture. The purpose of this project is to build Armenia's capabilities in agricultural production and marketing.

USU International Irrigation Center Directors: Edwin C. (Ted) Olsen and Humberto L. Yap-Salinas

The Biological and Irrigation Engineering Department is engaged in an extensive program of international irrigation technology transfer and is contributing significantly to the alleviation of the world hunger problem through multi-lingual training and research in irrigation and drainage. The International Irrigation Center has been organized to provide an appropriate entity within which to sponsor these ongoing training activities.

The USU Institute for International Rural and Community Development Director: Brad W. Parlin

The institute coordinates the international development activities of Utah State University's social sciences faculty. Its main objective is to actively participate in overseas research, extension, teaching, and curriculum development. Acting as a funding center for over two dozen development specialists, the institute is able to design, execute, evaluate, or assist international development projects from an interdisciplinary base.

Center for International Studies Director: Yun Kim

The Center for International Studies promotes and coordinates international academic exchanges between Utah State University and the institutions of higher education abroad. The major objectives of the center are: (1) to develop bilateral university linkage programs, (2) to facilitate faculty and student exchange programs, and (3) to promote collaborative research programs, joint seminars, workshops, and conferences. The center also serves as the university academic center for international studies curriculum offerings and the Certificate Program for International Development.
Consortium for International Development

Trustees: Morris D. Whitaker and A. Bruce Bishop

Utah State University is a member of the Consortium for International Development, which was incorporated in Utah in 1972 and is a continuation of the founding organization known as CUSUSWASH, which dates back to 1967. A legal nonprofit corporation, the consortium is concerned with the orderly development of increased world food production and nutrition.

The consortium brings together the expertise of 12 universities located in the western United States. In addition to USU, member universities are: University of Arizona, California State Polytechnic University/Pomona, Colorado State University, University of Hawaii, University of Idaho, University of Montana, New Mexico State University, Oregon State University, Texas Tech University, Washington State University, and University of Wyoming.

The consortium is governed by a Board of Trustees, with two trustees appointed by the president of each member institution. The board defines policy and guidelines and has delegated the implementation and management of the consortium to an executive director, secretary/treasurer, and appropriate staff.

USU/University of Wisconsin/Euroconsult/World Bank/Bolivia Agricultural Research

Coordinator: Weldon S. Sleigh

This project provides long- and short-term advisory services and training to Bolivia's agricultural research institute and extension service.

During summer quarter, nonresident and resident students are assessed the same tuition per credit as that assessed resident students during the regular academic year, except Intensive English students who pay the regular fees for international students.

**Tuition and Fees**

The University reserves the right to alter any of these charges without notice. Check the quarterly class schedule for current fees.

**Tuition-fee Schedule for Graduate Students**

<table>
<thead>
<tr>
<th>Credits</th>
<th>Utah Resident</th>
<th>Non-resident*</th>
<th>International Students**</th>
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<tr>
<td>1</td>
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<td>4</td>
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<td>5</td>
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<tr>
<td>25</td>
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</table>

Over 25 Additional fee of $35.00 per credit hour for residents (U.S. citizens and immigrants). Additional fee of $124.00 per credit hour for nonresidents and foreign students (non-U.S. citizens and nonimmigrants).

Other Fees, Costs

All fees and costs are subject to change.

- **Graduate Record Examination**
  - General Test: $44
  - Subject Test: $44

- **Graduate Management Admission Test GMAT** (for business and accounting applicants from the United States, Puerto Rico, and Canada): $30

- **Miller Analogies Test** (For some education applicants): $33

- **Test of English as a Foreign Language (TOEFL)**: $31

- **Application Fee (nonrefundable)**. U.S. citizens, $30; international students, $35.

- **Automobile Parking Permit**. $20 per year.

- **Late Registration Fee** (beginning first day of classes). $20

- **Deferred Fee Note Fee**. $22 per quarter. An additional note fee of 12 percent per annum will be assessed from the date of the note until paid if the note becomes delinquent.

- **Audit or Visitor Fee**. Same rate as classes with credit (except for persons 62 years of age and older who are permitted to audit free of charge after a recording fee of $10 per quarter has been paid.)

**Health and Accident Insurance.** Students may purchase health and accident insurance at the time of registration. Additional insurance is available for spouses and children.

All international students are required to have medical insurance for themselves and for their accompanying dependents. They must purchase one of the student health insurance plans available through the University.

Premiums are charged on a tri-annual basis to provide coverage for the summer and eliminate breaks in coverage that would jeopardize receipt of claims. If students are enrolled in one of the student health insurance plans during spring quarter, coverage will be automatic for the summer quarter.
Option #Premium Categories

<table>
<thead>
<tr>
<th>(Choose One)</th>
<th>Per Quarter</th>
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<tbody>
<tr>
<td>Student only</td>
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</tr>
<tr>
<td>1. $20,000/Occurrence</td>
<td>$160</td>
</tr>
<tr>
<td>2. $50,000/Occurrence</td>
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<tr>
<td>3. $100,000/Occurrence</td>
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<td>Student and spouse</td>
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<td>4. $20,000/Occurrence</td>
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<tr>
<td>5. $50,000/Occurrence</td>
<td>$785</td>
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<tr>
<td>6. $100,000/Occurrence</td>
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<tr>
<td>Student and one or more children (This category is for single parents only.)</td>
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<td>7. $20,000/Occurrence</td>
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<td>8. $50,000/Occurrence</td>
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<td>9. $100,000/Occurrence</td>
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<tr>
<td>Student, spouse, and one child</td>
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<td>10. $20,000/Occurrence</td>
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<td>11. $50,000/Occurrence</td>
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<td>12. $100,000/Occurrence</td>
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<tr>
<td>Student, spouse, and two or more children</td>
<td></td>
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<tr>
<td>13. $20,000/Occurrence</td>
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<tr>
<td>15. $100,000/Occurrence</td>
<td>$1285</td>
</tr>
</tbody>
</table>

Students registered for 7 or more credits may utilize the services of the Student Health Service during its office hours; these services include free consultation on health matters, office care for minor emergencies, medical advice to seek for further consultation, and routine inoculations and immunizations. Students registered for fewer than 7 credits must pay a fee to use Student Health Services.

The health and accident insurance options provide protection for medical needs not covered by Health Service to spouses and children and to students registered for fewer than 6 credits.

Continuous Graduate Registration. All graduate students must be continuously registered until they complete all requirements for the degree. Students must be enrolled for a minimum of three credits per quarter (summer quarters and, in some cases, the quarter of completion excepted). To meet this minimum, students may register for regular courses or for 699 or 799 (Continuous Graduate Advisement).

a. Continuing Graduate Advisement Course(s). There is no limit on the number of times a student may register for 699 or 799 credit. The cost of 699 or 799 credit is equivalent to standard tuition charges, but nonresident tuition is not charged.

b. Continuous Registration Fee. A graduate student who is not registered and is not using University facilities or faculty time may, with the permission of the department and the graduate dean, meet the continuous registration requirement by paying $10 per quarter. Further information on the continuous graduate registration policy is found on page 28.

Thesis and Dissertation Binding Fee. Two copies must be submitted to the School of Graduate Studies for binding. Students are required to pay $20 for this binding. Additional copies may be bound for $10 each.


Master's students must submit a copy of their thesis and pay $40 for microfilming of it.

Transcript of Credits. The transcript fee (per transcript) is $3. Transcripts will not be issued unless the money accompanies the order.

Graduation Fee

<table>
<thead>
<tr>
<th>Cap and Gown Rental</th>
<th>$15</th>
</tr>
</thead>
<tbody>
<tr>
<td>Master's</td>
<td>$12</td>
</tr>
<tr>
<td>Doctor's</td>
<td>$12</td>
</tr>
</tbody>
</table>

Refund of Registration Fees. When a student withdraws from the University not later than the end of the third week of the quarter, he or she is entitled to a refund of registration fees according to the following conditions:

1. Ten dollars of every registration fee, the late registration fee, and the insurance premium are nonrefundable.

2. After the above is deducted from the amount paid, refunds are calculated as follows:

Refund period

<table>
<thead>
<tr>
<th>Percent of registration fee to be refunded</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before quarter classes begin</td>
</tr>
<tr>
<td>First two days of the quarter</td>
</tr>
<tr>
<td>Third through the fifth day of classes</td>
</tr>
<tr>
<td>Through the tenth day of classes</td>
</tr>
<tr>
<td>Through the fifteenth day of classes</td>
</tr>
<tr>
<td>After the fifteenth day of classes</td>
</tr>
</tbody>
</table>

3. No refund will be made unless the student's official receipt for the current registration fees and activity card are surrendered to the Cashiers Office.

4. Special provisions apply to students who are required to withdraw during the quarter for active duty in the military forces.

Activity Validation Sticker. An activity validation sticker is included for students registering for 7 or more credits. Students registered for fewer than 7 credits may purchase an activity validation sticker for $40.00. A student who holds an activity validation sticker may purchase an additional validation sticker for his or her spouse for $20.00. A lost activity validation sticker may be replaced for $5.00.

University Publications. The following catalogs and schedules are available at the University Bookstore and through the mail. Mail requests for undergraduate catalogs (general) or University college schedules should be addressed to: High School/College Relations, Utah State University, Logan, UT 84322-0160. Mail requests for graduate catalogs should be addressed to the Bookstore, Utah State University, Logan, UT 84322-0200.

Undergraduate Catalog (general) | $4.50
Class Schedules (published quarterly) | $2.00
Graduate Catalog | $3.00

Publications will not be sent until money is received.

Dishonored Check Fee. In addition to a $15 service charge, students will be charged the late fee in effect at the time a dishonored check is redeemed.

Housing Services

Housing Services
Utah State University
Logan, Utah 84322-8600
tel. (801) 757-3113

Housing Services

The convenience and amenities of living on campus are offered through Housing Services. In single student hous-
Financial Assistance

Application for assistantships, fellowships, and other financial aid should be made through departmental offices. USU conforms to the agreement made among most graduate schools in the United States that when a student accepts an offer of financial assistance before April 15 and then wishes to withdraw, a resignation of the appointment may be submitted in writing at any time through April 15. However, an acceptance given or left in force after April 15 precludes the student from accepting another offer without first obtaining a written release from the institution to which a commitment has been made.

Graduate Assistantships

Teaching, research, and other graduate assistantships are available in most of the departments of the University. The maximum total University workload for full-time graduate students is one-half time (20 hours per week), whether paid on contract, payroll, or both. Graduate assistants must be full-time, matriculated students with a GPA of 3.0 or higher (see Classification of Students section, pages 26-27). Graduate assistants may register for a maximum of 12 credits per quarter, except research assistants whose assistantship involves their thesis or dissertation research (see below).

Teaching Assistantships. Graduate students receive teaching assistantships in departments. The contracts typically cover the periods October 1 to May 31 or September 15 to June 15. The teaching load varies from one-fourth to a maximum one-half time (20 hours per week), whether the assistant is paid on contract, payroll, or both. Stipends vary depending on the department and the teaching load.

Students from non-English-speaking countries may be considered for teaching assistantships if they demonstrate adequate proficiency in English communication, as determined by Utah State University's Intensive English Language Institute, and participate in the required workshop.

All teaching assistants are required to participate in a training workshop sponsored by the School of Graduate Studies prior to beginning their assistantships. The workshops help students gain the techniques and skills to be effective instructors in the university environment. The workshop for international students also aids students in understanding the sociocultural behaviors they can expect to find at USU and identifies English-usage problems that might cause communication problems.

Research Assistantships. As for teaching assistants, the stipends and workloads for research assistants vary, with a maximum workload of 20 hours per week, whether paid on contract, payroll, or both. Students conducting research that will be used for their thesis or dissertation may register for 4 research or thesis credits above the 12-credit limit.

Federal College Work-Study Assistantships. Graduate students who are eligible for work-study support (the maximum stipend is $3,000) apply for these competitive assistantships through departments and the Financial Aid Office.

Waiver of the Nonresident Portion of the Tuition Fee. A nonresident student who holds a graduate assistantship may be awarded a waiver of the nonresident portion of tuition. The department head recommends waivers to the college deans for approval. The waivers are then submitted to the graduate dean for approval at least three days before the last day for students to register or add classes for the quarter for which the waiver is requested. Waivers for the academic year may be submitted before fall quarter. A tuition waiver must be used before the last day for registering or adding classes in the quarter for which it was awarded.

WICHE Programs

Agricultural Meteorology, Atmospheric and Space Science, Molecular Biology, and Toxicology are approved as Western Regional Graduate Programs by the Western Interstate Commission for Higher Education (WICHE). Residents of participating states may enroll in these programs without paying nonresident tuition. Information is available in the School of Graduate Studies.

Fellowships

A number of fellowships and scholarships awarded by the School of Graduate Studies are described below. Awarded must be full-time, matriculated students. Application for these, as well as for departmental fellowships and awards, is made through the departments, except for the Martin Luther King Fellowship (see below).

President’s Fellowships include a stipend for the academic year and a waiver of the nonresident portion of tuition. Criteria include a 3.70 GPA and quantitative and verbal GRE scores at the 80th percentile or above. Students should apply through their departments. The deadline for nominations by departments is April 1.

Vice President for Research Fellowships include a stipend for the academic year and waiver of the nonresident portion of tuition. Criteria include a 3.70 GPA and quantitative and verbal GRE scores at the 80th percentile or above. The student must be in a research degree program that includes a master’s thesis or doctoral dissertation. Departments must nominate fellowship candidates for the following school year by April 1.

University Graduate Fellowships are awarded for the academic year and include a waiver of the nonresident portion of tuition. Criteria are the same as for Vice President for Research and President’s Fellowships.

Summer Fellowships are to help students finish degree programs during summer quarter. They are paid at the beginning of summer quarter.

Martin Luther King Fellowships are available to African-American students. In addition to the $2,000 fellowship and a waiver of the nonresident portion of tuition, the department usually awards an assistantship, the
amount of which varies. Application for this fellowship is made through the School of Graduate Studies. The deadline is April 1.

Scholarships

Nonresident Tuition Scholarships. Scholarships covering the nonresident portion of tuition are available each quarter on a competitive basis through the departments. GPA, GRE scores, and other evidence of scholastic merit are the criteria for making the awards. Awardees must be full-time matriculated students and must maintain a 3.0 or higher GPA.

The Seely-Hinckley Scholarship is awarded each year to two needy graduate students of superior achievement. Departments are responsible for nominating by May 1 top scholars who are candidates for the following school year.

Other Financial Assistance

Many students who do not receive assistantships or fellowships receive financial assistance by working for departments or other campus units. The maximum total University employment for a full-time graduate student is 20 hours per week.

Graduate students may apply for Federal Stafford Loans, Federal Perkins Loans, Federal Supplemental Loans for Students (SLS), Emergency Loans, and Federal College Work-Study through the Financial Aid Office. More information can be found in the undergraduate catalog of the University or at the Financial Aid Office.

Financial Aid Office
Taggart Student Center 106
Utah State University
Logan, UT 84322-1800
tel. (801) 797-0173

GI Bill Benefits
Office of Veterans Affairs
Taggart Student Center 225
Utah State University
Logan, UT 84322-1600
tel. (801) 797-1102

Veterans and students eligible for a veteran’s education allowance must be matriculated graduate students in order to receive GI Bill benefits. To be matriculated, a student must have been accepted by a department to an approved graduate degree program, with the concurrence of the dean of the School of Graduate Studies.

Measurement of Training Timetable
Graduate Degrees

<table>
<thead>
<tr>
<th>Full Time</th>
<th>6 credits or more</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/4 Time</td>
<td>4 and 5 credits</td>
</tr>
<tr>
<td>1/2 Time</td>
<td>3 credits</td>
</tr>
</tbody>
</table>

It is the veteran’s responsibility to immediately report changes in credit hours that will affect pay; changes in address, schools, major, or number of dependents; termination; and withdrawals. Failure to report changes promptly may result in overpayment that will be reclaimed by the Veteran’s Administration.

To be eligible for benefits, the student must be a full-time matriculated graduate student (see pages 26-27).
Degrees Offered

Accounting ........................................... MAcc
Agricultural Economics ............................. MA, MS
Agricultural Systems Technology ............... MA, MS
American Studies ................................. MA, MS
Animal Science ...................................... MA, MS, PhD
Aquatic Ecology ..................................... MS, PhD
Art .................................................... MA, MFA
Biochemistry ........................................ MS, PhD
Biological & Agricultural Engineering .......... MS, PhD
Biology ............................................... MS, PhD
Biology Ecology ..................................... MS, PhD
Biometeorology ...................................... MA, MS, PhD
Bovine Science ...................................... MA, MS
Business Administration ........................... MBA
Business Information Systems and Education . MEd, MS, EdD*, PhD*
Chemistry ............................................ MA, PhD
Civil and Environmental Engineering .......... ME, MS, CE, PhD
Communication ..................................... MA, MS
Communicative Disorders ........................ MEd, MA, MS, EdS, EdD*, PhD*
Community Economic Development .............. MCED
Computer Science ................................... MS
Curriculum and Instruction ........................ EdD*, PhD*
Dairy Science ........................................ MA, MS
Economics ........................................... MA, MS, MSS*, PhD
Electrical Engineering ............................. ME, MS, EE, PhD
Elementary Education ............................. MEd, MA, MS, EdD*, PhD*
English ............................................... MA, MS
Family and Human Development ............... MS, PhD*
Family Life .......................................... PhD*
Fisheries and Wildlife ............................. MS, PhD
Forest Ecology ....................................... MS, PhD
Forest Management ................................ MF
Forestry ............................................. MF, MS, PhD
Geography ........................................... MA, MS
Geology ............................................. MS
Geology Ecology .................................... MS
Health, Physical Education and Recreation .... MEd, MS
History ............................................... MA, MS, MSS*
Human Environments .............................. MA, MS
Human Resource Management .................... MSS*
Industrial Technology ............................. MS
Instructional Technology ........................ MEd, MS, EdS, EdD*, PhD*
Irrigation Engineering ............................. PhD
Irrigation Science ................................... MS
Landscape Architecture ........................... MLA, MS
Management and Human Resources ............ MSS*
Mathematical Sciences ............................ PhD
Mathematics ......................................... MS, MA
Mechanical Engineering ........................ ME, MS, PhD
Nutrition and Food Sciences ..................... MA, MS, PhD
Physical Education ................................. MS, PhD
Physics ............................................. MA, MS, PhD
Plant Ecology ....................................... MS, PhD
Plant Science ....................................... MA, MS, PhD
Political Science .................................... MA, MS
Psychology .......................................... MA, MS, PhD
Range Ecology ...................................... MS, PhD
Range Science ....................................... MS, PhD
Recreation Resource Management .............. MS, PhD
Research and Evaluation ........................ EdD*, PhD*
Secondary Education .............................. MEd, MA, MS, EdD*, PhD*
Sociology ........................................... MA, MA, MSS*, PhD
Soil Science .......................................... MA, MS, PhD
Special Education ................................. MEd, MS, EdS, EdD*, PhD
Statistics ........................................... MS
Theatre Arts ......................................... MA, MFA
Town and Regional Planning ..................... MS
Toxicology ........................................... MS*, PhD*
Watershed Science ................................ MS*, PhD*
Wildlife Ecology .................................... MS, PhD

*Interdepartmental degree
Admission Procedures

School of Graduate Studies
Utah State University
Logan, UT 84322-0800
tel. (801) 797-1189

Requirements

Application for admission forms are obtained from and returned to the School of Graduate Studies. The form must be accompanied by a nonrefundable application fee of $36 for U.S. citizens and $35 for international students. Note: Fees must be paid before applications will be evaluated.

Transcripts. Two official transcripts must be ordered from each previously attended college and/or university (except USU) and must be sent directly from each institution to the USU School of Graduate Studies. Transcripts must be submitted for all courses above the high-school level and all prior degrees. Transcripts accumulated on one record are not acceptable. Transcripts submitted as application credentials become the property of the School of Graduate Studies and will not be copied or returned to the applicant. A bachelor's degree from an accredited college, with a minimum 3.0 GPA for the last 90 quarter or 60 semester credits earned, is required.

Admissions Tests. An admission test is required of all applicants, with a score at or above the 40th percentile the minimum acceptable. Most applicants must take the Graduate Record Examination (GRE) general test (minimum of 40th percentile on the verbal test and on the quantitative test). Those applying to Computer Science, Physics, or Mechanical and Aerospace Engineering are also required to take the GRE subject test for computer science, physics, or for engineering, respectively, and international students applying to Chemistry and Biochemistry must take the appropriate GRE subject test. Some departments will accept the Miller Analogies Test (MAT) for master's degree applications. Applicants to the Master of Business Administration, the MS in Business Information Systems and Education, and Master of Accounting programs are required to take the Graduate Management Admission Test (GMAT). Registration forms for the GRE and the GMAT are available at the School of Graduate Studies. Applicants should request that their scores be sent directly to the School of Graduate Studies. The scores must be received before an application is considered complete.

Application Recommendation Request Forms are included in the application packet. They should be used to request three persons to submit letters of recommendation (at least two of which should come from persons familiar with the applicant's academic performance). The letters must be sent directly to the School of Graduate Studies by the writers.

International Applicants. In addition to the above, international applicants from non-English-speaking countries must score a minimum of 550 on the Test of English as a Foreign Language (TOEFL), which is administered throughout the world. If an international applicant has a degree from a university in an English-speaking country, the TOEFL is not required.

Applicants who are admitted but have not scored 550 on the TOEFL or who have not obtained a degree in an English-speaking country are required to take the English Language Placement Test given by the Intensive English Language Institute (IELI) at USU. The test is required before a student is allowed to register. The results of the exam are used to place students into one of three categories: (1) full-time study of English (Intensive English Program), (2) a combination of English language study and academic study, or (3) full-time academic study. Students in the Intensive English Program are required to remain in that program until the required English proficiency is attained and are not allowed to register for other classes. Students in categories 2 and 3 should meet with their academic advisers to plan class schedules.

Transcripts not in English must be accompanied by a notarized translation. International students must also submit an I-20 application form, a financial certificate, and a financial guarantee. Because of immigration regulations, international students cannot be admitted with nonmatriculated status.

Application Deadlines. Completed application forms, transcripts, letters of recommendation, test scores, and the application fee should be submitted on or before the following dates (some departments have different deadlines; see department descriptions). It may not be possible to process applications for the following quarter when they are submitted late.

April 15 for summer quarter
July 15 for fall quarter
October 15 for winter quarter
January 15 for spring quarter

As soon as an application is complete, a recommendation is made by the appropriate department to the graduate dean, who must approve all admissions. No notification of acceptance or rejection other than that from the graduate dean is official.

Summer Quarter Admission

The summer quarter consists of two one-week presessions for workshops and short special programs, an eight-week quarter of regular coursework, and a postsession of one week for workshops and seminars. Nonresident students pay only resident tuition for summer quarter credits.

A graduate student who is in a planned program that allows enrollment for only summer quarter must inform the School of Graduate Studies and complete a Graduate Census Sheet. The student then remains eligible to register for each subsequent summer quarter.
All summer quarter students are eligible to register the following fall quarter.

Program Continuity and Readmission

A new Graduate Census Sheet must be submitted to the School of Graduate Studies if (1) attendance is interrupted for one quarter (excluding summer quarter) or more, (2) a degree is awarded, or (3) a student attending summer quarter only misses a summer. The sheet should be submitted 30 days prior to the beginning of the quarter during which the student wishes to attend. If a graduate student’s attendance is interrupted for more than one quarter, the department or School of Graduate Studies may require the student to reapply for admission. Also, a readmission fee may be charged if a student begins a graduate program after the quarter for which he or she was accepted.

Establishing Residency

Residency Office
Taggart Student Center 246
Utah State University
Logan, UT 84322-1600
tel. (801) 797-1107

Nonresident students who feel they have met the requirements for in-state resident student status must file an official residency application with the Residency Office, Taggart Student Center 246, no later than seven calendar days from the first class day and not more than 30 days before the beginning of the quarter for which residency is sought. Those missing the application deadline will have residency considered for the next quarter, provided that the next appropriate deadline is met with adequate updated documentation.

If an application is denied by the Residency Officer, the student may appeal to the Residency Appeals Committee.

General Regulations

Each graduate student is responsible to be knowledgeable about the policies, regulations, and procedures of the School of Graduate Studies and his or her department or program, and to see that they are followed and that the timelines are met. The policies and regulations stated in this catalog and in departmental handbooks may be changed between publication dates, and students are responsible to obtain up-to-date information.

Time Limit

A master’s degree must be completed within six years of admission. A doctorate must be completed within eight years of admission, unless a department or program has established a six-year limit.

Coursework that is more than six years old for a master’s degree or eight years old (or six years, if that is the departmental limit) for a doctorate must be revalidated following a plan developed by the student’s supervisory committee and approved by the dean of the School of Graduate Studies. The revalidation may include testing or coursework. Work experience cannot be used to replace outdated coursework. The supervisory committee must submit to the graduate dean a signed statement verifying that the agreed-upon procedures were followed and specifying the outcome.

Credits from another institution that exceed the six-year master’s limit or the eight-year (or less) doctoral limit at the time of degree completion may be transferred to a USU graduate degree only if the student’s supervisory committee provides a justification acceptable to the graduate dean. Then, the revalidation procedures described above apply.

Classification of Students

A matriculated graduate student has been accepted by a department, with the concurrence of the dean of the School of Graduate Studies, to an approved graduate degree program. A student may be matriculated on a provi-
sional basis when (1) information, such as GRE scores, is yet to be received in the School of Graduate Studies Office, or (2) when a missing prerequisite or academic deficiency must be remedied. The conditions and time limit for meeting them must be specified to the student in writing at the time of admission. If the conditions are not met as specified, the student’s participation in the degree program will be terminated. International students cannot be admitted on provisional status.

A full-time matriculated graduate student must be one of the following:

1. Registered for 6 or more graduate credits;

2. Registered for 3 credits with all required coursework completed and only the research component for the degree remaining (the student’s Program of Study must have been submitted to the School of Graduate Studies Office and the major professor must verify by letter to the School of Graduate Studies Office that the student has only the research component remaining before the dean of the School of Graduate Studies approves the full-time status); or

3. Registered for at least 3 credits the quarter of the final thesis/dissertation defense or, in a nonthesis degree program, the quarter of completion.

A matriculated-probationary graduate student has been put on warned status because of inadequate progress in his or her degree program.

Graduate assistants and fellowship recipients must be full-time matriculated students with a GPA of 3.0 or above, and be registered each quarter of the assistantship or fellowship, including summer.

A nonmatriculated postbaccalaureate student holds a bachelor’s degree but has not been accepted to a graduate degree program, but may be working toward certification or recertification. These students should apply to the undergraduate Admissions Office (USU, Logan, UT 84322-1600, tel. [801] 797-1096). A maximum of 18 credits earned as a nonmatriculated student may be used in a graduate degree program, but only if approved by the student’s supervisory committee.

An international student with a bachelor’s degree who wants to take graduate-level coursework at USU, but not be in a graduate degree program, must apply through the undergraduate Admissions Office (USU, Logan, UT 84322-1600, tel. [801] 797-1096). For other information about the University, he or she can contact the International Students and Scholars Office (Logan, UT 84322-0140, tel. [801] 797-1124).

A Split Form may be submitted by an undergraduate student at USU who is within 45 credits of completing bachelor’s degree requirements, has a 3.0 or higher GPA, and has applied for admission to the School of Graduate Studies. Undergraduates may not register for graduate classes without the instructor’s approval unless a Split Form, showing a division of courses between undergraduate and graduate programs, has been approved. The Split Form should be filed before grades are posted for the quarter requested to be split. A Split Form cannot be processed after the bachelor’s degree has been closed out. The form must be signed by the department head and/or undergraduate adviser before it is submitted to the School of Graduate Studies Office. If approved by the dean of the School of Graduate Studies, the form will be processed and forwarded to the Graduation Office.

Course-Level Numbering and Acceptability

700-799 are doctoral-level courses.

600-699 are master’s-level courses.

500-599 are advanced, upper-division courses and may be used in a graduate program if approved by the supervisory committee.

400-499 are upper-division courses and may be approved by the supervisory committee, subject to final approval by the dean of the School of Graduate Studies. Ordinarily, such courses must not be those required by the student’s department of major study for a bachelor’s degree in that field and, if needed, should be taken as prerequisites. No more than six 400-499-level credits can be applied toward an advanced degree.

300-399 are junior- and senior-level courses. If they are outside the student’s major field, they may be accepted by the supervisory committee, subject to approval of the dean of the School of Graduate Studies. No more than six 300-399-level credits can be applied toward an advanced degree.

No more than a total of six 300-499-level credits may be included in a graduate program. Courses below 300 are not acceptable for graduate credit.

At the end of each course description, the number of credits given for the course and the quarter(s) it will likely be taught are listed in abbreviated form. For example, (3F,W,Sp,Su) indicates a 3-credit course that will likely be taught fall quarter. The designation (5F,W,Sp,Su) indicates that a 5-credit course will likely be taught all four quarters: fall, winter, spring, and summer. It does not mean that the student has to take the class all four quarters. With some listings, the course will not be taught each quarter, and the exact quarter the course will be taught is yet to be decided.

A course number in parentheses preceded by an f indicates a number previously used for the course. A d indicates a dual listing.

Audited courses may not be used for a degree program or toward status as a full-time student.

Grading System

Letter grades modified by plus and minus symbols are recorded on transcripts. The grading range and the points assigned to compute cumulative averages are as follows:

- A 4.00 C 2.00
- A- 3.67 C- 1.67
- B+ 3.33 D+ 1.33
- B 3.00 D 1.00
- B- 2.67 F 0.00
- C+ 2.33
Graduate students are required to maintain at least a 3.0 GPA for degree-program courses. Grades below C will not be accepted. Some departments do not accept C grades.

**Incomplete Grades.** A maximum of 12 months is allowed to remove incomplete grades (except those given for thesis research credit, which are changed by the adviser at the time of completion), as arranged with the instructor. Grade change forms are available from the Office of Admissions and Records. Official transcripts showing degrees earned cannot be issued until incomplete grades are changed for courses on the student's program of study.

**P-Grade Policy.** P (Pass) will be accepted only for seminars, special problems, interdisciplinary workshops, thesis or dissertation research, and continuing graduate advisement.

**Course Repetition.** A course may be repeated to improve a grade. If a course is repeated, the second grade earned will be official. The original course will remain on the transcript, marked with an asterisk, but will not be counted in the GPA. All course repetitions must be approved by the instructor.

**Graduate Credits**

**Transfer of Graduate Credits.** A student's supervisory committee may recommend transfer of course or research credits earned at another accredited institution as part of a graduate program. The credits must not have been used for another degree. Only 18 credits earned before matriculation at USU may be transferred. Credits with P grades cannot be transferred. Transfer credits cannot replace required residency credit. Transfer credits are subject to approval of the supervisory committee and the dean of the School of Graduate Studies.

**Credit by Special Examination.** Credit earned by special examination cannot be used to satisfy the course requirements for a graduate degree or to meet the residency requirement.

**Extension Course Credits.** Approved Graduate Programs of Instruction are offered at designated University centers. Continuing Education independent study (correspondence) courses are not accepted for graduate degrees.

**Use of Facilities**

Students who have finished their coursework, but are using the library, laboratories, or other University facilities and/or are under faculty supervision for completing their degrees must register for a minimum of 3 credits each quarter.

**Rights in Inventions**

It is the student's responsibility to be aware of University policy in regard to property rights in student inventions. (Information is available in the School of Graduate Studies.)

**Research Approval**

All University research that involves human subjects, use of animals, radiation or radiological materials, or biohazardous materials must be reviewed and approved by the appropriate University committee(s) before the research is started. Graduate students are, with the assistance of their advisers, responsible for obtaining the necessary approval for their research. Approval must be obtained before the research is started and must be submitted to the School of Graduate Studies Office before the student's master's Program of Study or doctoral Application for Candidacy can be approved. For further information, contact the School of Graduate Studies Office or the Office of the Vice President for Research.

**Continuous Graduate Registration**

Graduate students must be registered every quarter except summer (and also summer, if employed as a graduate assistant that quarter) until completion of all degree requirements, including approval of a thesis or dissertation by the graduate dean, payment of all fees, submission of all necessary forms, and submission of the thesis or dissertation for binding.

Students must be continuously enrolled for courses, seminars, independent study, research credit, or 699 or 799 (Continuing Graduate Advisement) for a minimum of 3 credits of graduate work every fall, winter, and spring quarter until they complete all degree requirements, except, in some cases, the quarter of completion itself (see below). More than 3 credits of continuous registration may be required by a department or college.

A graduate student who is not using University facilities or faculty time may meet the continuous registration requirement by paying the Continuous Registration Fee of $10 per quarter (not necessary for summer quarter). This alternative requires a written request from the department head, including verification that the student is not using University facilities and/or faculty time. International students are usually not eligible because of immigration regulations.

The quarter a student defends (or redefends) a thesis, Plan B paper, or dissertation or takes final oral examinations, he or she must be registered for 3 credits. If the graduation requirements are completed in a quarter other than the quarter of defense or final examination, the student must register for 1 credit. The Continuous Registration Fee does not fill this requirement.

The continuous registration requirement goes into effect the quarter after a student is admitted to the School of Graduate Studies as a matriculated or nonmatriculated student. When appropriate graduate admission procedures are not followed, the School of Graduate Studies may apply the continuous registration requirement retroactively.

**Leave of Absence**

A leave of absence, during which continuous registration is not required, may be granted under the following conditions:

1. Illness, required military service, and other extenuating circumstances acceptable to the department head and the graduate dean.
2. Participation in a planned Extension program in which courses are taken as they are made available by USU. Leaves of absence will be granted for those quarters in which courses are not provided.

3. Participation in a planned program based primarily on summer school courses.

For both 2 and 3, the student must have an approved Program of Study on file in the School of Graduate Studies Office before a leave will be granted.

All leaves of absence must be approved by the graduate dean.

Notice of Failure to Register and Reactivation Procedures

Students who do not maintain continuous registration will be notified and a copy of the notification will be sent to the department. If, after notice, the student fails to register, the student’s records will be put on inactive status. At the discretion of the department, the student may be required to reappear or his or her file may be reactivated if the time limit for the degree has not expired. To reactivate, the student will be required to pay the Continuous Registration Fee for quarters missed.

Low-Scholarship Notification

Students whose quarterly GPA falls below 3.0 will be notified.

Students whose GPA falls below 3.0 for two consecutive quarters may be reduced to nonmatriculated status or their graduate program may be terminated. In the latter case, reapplication is required to regain matriculation. Should a student holding a University appointment as a teaching or research assistant or fellow be reduced to nonmatriculated status, the assistantship or fellowship will be terminated. Computation of the GPA will be based on courses identified by the student’s department and/or supervisory committee as required graduate courses.

This policy applies to all graduate students; however, departments may have more restrictive scholarship policies.

Monitoring of Progress

The student’s department and the School of Graduate Studies monitor the progress of graduate students. For continued participation in a graduate program, a student must complete requirements in a timely manner with scholarship and independence. In reviewing a student’s progress, several factors will be considered, including demonstrated ability to develop a thesis proposal, independence in the conduct of research, performance on comprehensive examinations, GPA, and special program requirements.

Matriculation of Faculty

It is the policy of USU not to grant advanced degrees to its own faculty, except under unusual circumstances.

Academic Honesty

The University expects that students and faculty alike maintain the highest standards of academic honesty. For the benefit of students who may not be aware of specific standards of the University concerning academic honesty, the following paragraph is quoted from the Student Policy Handbook, Article V, Section 3, Paragraphs a, b, and c:

Section 3. Violations of University Standards

A. The following activities have been found to interfere with University functions or threaten the well-being and the educational purposes of students and are, therefore, specifically prohibited and make the student subject to discipline. The following list of violations is not an all-inclusive list; other misconduct may also subject the student to discipline.

1. Acts of academic dishonesty:
   a. Cheating includes intentionally: (1) using or attempting to use or providing others with any unauthorized assistance in taking quizzes, tests, examinations, or in any other academic exercise or activity; (2) depending upon the aid of sources beyond those authorized by the instructor in writing papers, preparing reports, solving problems, or carrying out other assignments; (3) substituting for another student, or permitting another student to substitute for oneself, in taking an examination or preparing academic work; (4) acquiring tests or other academic material belonging to a faculty member, staff member, or another student without express permission.
   b. Falsification includes the intentional and unauthorized altering or inventing of any information or citation in an academic exercise or activity.
   c. Plagiarism includes knowingly representing, by paraphrase or direct quotation, the published or unpublished work of another person as one’s own in any academic exercise or activity without full and clear acknowledgement. It also includes the unacknowledged use of materials prepared by another person or agency engaged in the selling of term papers or other academic materials.

Violations of the above policy will subject the offender to the University discipline procedures as outlined in Article VI, Section 1 of the Handbook.

A. The penalties or disciplinary measures which the University may impose on a student include:

1. Warning or reprimand—written or verbal.
2. Grade adjustment—for either an assignment/test or the course.
3. Probation—continued attendance at the University predicated upon the student satisfying certain requirements as specified by the University Probation Committee. The student will be granted the opportunity to continue his or her studies for a specified period of time and includes the probability of more severe disciplinary penalties if the student does not comply with the specified requirements or is found to be violating any University regulations during the probationary period.
4. Suspension—temporary dismissal from the University for a specified time, after which the student is eligible to return. Conditions for readmission may be specified.
5. Expulsion—permanent dismissal from the University.
7. Payment of restitution to the University or, when University intervention is deemed appropriate, to another individual for damages or losses.
8. Withholding of transcripts for refusal to return University property, pay University debts, or other violations of University standards.
9. Denial or revocation of degrees.
11. Referral to psychological counseling or the Office of Substance Abuse Prevention/Education for assessment, evaluation, education, and treatment, when necessary.

B. More than one of the penalties or disciplinary measures may be imposed for any single violation. Reference to “penalty” includes multiple penalties.

C. Imposition of the penalty of suspension or expulsion from the University must be approved by the University president. The president’s approval shall be given either at the conclusion of the 10-day appeals period if no appeal is filed, or as part of the president’s final decision if an appeal is filed.

D. When a student is suspended or expelled from the University, tuition and fees that have been paid for the quarter during which the suspension or expulsion occurs are refundable in accordance with the standard refund policy as stated in the quarter class schedule.

E. A “packet hold” is not an independent penalty or disciplinary measure, but may be utilized by the University as a means to either direct a student’s attention to, and subsequent participation in, a pending discipli-
Research fraud may be reported during a student's program or after the program is completed. Whether fraud has occurred will be determined by following the procedures outlined in the publication Policy and Procedures on Research Fraud by Graduate Students. If a student is found guilty of research fraud, the penalty will include one or more of the following: (a) reprimand, (b) warning or probation, (c) suspension, (d) expulsion, (e) rewriting of the thesis or dissertation or correction and reanalysis of data, with resubmission and redefense of the thesis or dissertation, (f) loss of financial assistance, or (g) revocation of degree.

Appeals Procedure

Graduate students with grievances relating to academic matters may appeal to the dean of the School of Graduate Studies. Such appeal presupposes that the matter has been carried through appropriate procedures in the department(s) concerned. The Code of Policies and Procedures for the Student Community at Utah State University details the appropriate steps and procedures for such appeals.

Degree Requirements

Graduate students are responsible to be aware of degree requirements and to work with their major professor, supervisory committee, and department head to meet the requirements and specific deadlines.

Master's Degrees

When a student is matriculated in a master's degree program, the department head appoints a temporary adviser to work with the student until a supervisory committee is established. During the first quarter in a graduate degree program, the student should meet with the department head to discuss a supervisory committee. The completed Supervisory Committee form should be submitted by the department head to the dean of the School of Graduate Studies for final approval by the end of the student's second quarter. Committee members and the student are provided copies of the approved form by the School of Graduate Studies Office. Committee changes are not to be made during the six weeks prior to the final defense.

A supervisory committee must include at least three faculty members who are approved by the dean of the School of Graduate Studies. At least one member must represent the student's area of specialization, and at least one must be from outside the specialization area. Adjunct faculty can be members with the approval of the dean of the School of Graduate Studies.

The supervisory committee determines the course requirements for the student's degree program and supervises departmental qualifying examinations (if required). The committee also supervises the student's thesis research and the defense or final examination. The major professor, who serves as the chairperson of the committee, usually directs the thesis project.

Three copies of a Program of Study form, one of which must be the original with signatures in ink, must be submitted to the Graduate School Office by the student at least two months prior to the final examination or, for Plan C programs, completion of coursework. The candidacy form lists the courses in the degree program approved by the supervisory committee.

MBA and Accounting students must submit candidacy forms three months prior to completion of programs.

Plan A. The supervisory committee must verify the writing competency of all Plan A master's students. The method of competency verification is determined by the committee and/or department. The committee verifies writing competency on the Program of Study form.

The student and all committee members are required to sign a Data and Copyright form and a Plans for Publication form. The forms are given to the student with his or her copy of the approved Supervisory Committee form and must be submitted to the Graduate School Office with the Program of Study.

From 9-21 credits of thesis research are required. The thesis for a Plan A master's degree must be a contribution to the field of knowledge based on the student's own research or a treatment and presentation of known subject matter from a new point of view. The student and major professor should decide upon a problem or subject for the thesis study by the end of the student's second quarter of graduate study.

A Thesis Proposal, signed by the entire committee, should be submitted by the student to the School of Graduate Studies along with the Application for Candidacy form.

Plan B. The Plan B option requires the production of a paper or a creative work of art. At least 3 credits of thesis research are required, but no more than 3 credits of thesis credit can be counted toward a degree.
The Plan B paper is usually a review of literature, organized toward drawing conclusions after conceptualizing an area of inquiry, planning a systematic search, and analyzing and critiquing the acquired information. The summary and conclusions developed should enhance knowledge in the discipline.

Plan B papers and reports should follow the same format specifications as theses and dissertations and are expected to reflect equivalent scholarship standards, even though they may be less intensive and not demand the originality of a Plan A thesis. Plan B papers are defended, but are not reviewed by the School of Graduate Studies thesis coordinator or signed by the graduate dean. Plan B papers must be submitted to the library to be microfiched.

**Plan C.** An option that includes only courses, with no thesis or report, is available in some departments. A departmentally approved program must be filed in the School of Graduate Studies. Generally, a course or seminar on research methods is required, but thesis credits are not accepted. Plan C students should contact the School of Graduate Studies early in their final quarter to be certain that all degree requirements, including completion of graduation forms, will be met.

**Master of Arts.** Requirements for the Master of Arts degree (except in the Art Department) include two years (approximately 25 credits) of an acceptable foreign language or the equivalent, as determined by testing arranged by the supervisory committee and approved by the department and the graduate dean. One year each, or the equivalent, of two languages is acceptable if approved by the student’s committee.

**Master of Education.** The emphasis for the MEd degree is on improving the competencies of professional educators. The MEd degree is a planned program that includes a creative project and a final defense.

**Other Master’s Degrees.** For information on other master’s degrees, see individual departmental descriptions.

**Credit Requirement.** The minimum requirement for a Master of Science or Master of Arts degree is 45 credits, except for a Plan C degree for which the minimum is 51 credits. For the MEd degree, the minimum number of credits is 54. At least 36 credit hours must be in residency. Credits in the following areas are not acceptable: language, continuing graduate advisement, individual home study, military science, religious instruction, and courses numbered below 300. No more than 12 workshop credits may be applied to a master’s degree.

With committee approval, graduate credit can be transferred from accredited graduate schools, provided the minimum residency requirement of 36 credits (including thesis credit) at USU is met. The six-year time limit for coursework also applies to transfer credit. Transfer credit must not have been used for any other degree, and it will be shown on official USU transcripts at completion of the degree.

**Doctoral Degrees**

When a doctoral student is matriculated, the department head appoints a temporary adviser to work with the student until a supervisory committee is established. A **Supervisory Committee** form must be submitted to the dean of the School of Graduate Studies for approval by the end of the student’s fourth quarter. Each committee member is provided a copy of the approved form by the School of Graduate Studies. Committee changes are not to be made during the six weeks prior to the final defense.

A supervisory committee must include at least five faculty members with doctoral degrees who are approved by the dean of the School of Graduate Studies. Three members must be from within and at least one must be from outside the department or interdepartmental degree-granting program in which the student is matriculated. Adjunct faculty can serve on doctoral committees with the approval of the dean of the School of Graduate Studies.

The supervisory committee specifies the course requirements for the degree, approves the dissertation proposal, and supervises the student’s research, qualifying examination, preparation of the dissertation, comprehensive examination, and the final oral examination. The major professor is the chairperson of the committee and usually directs the student’s research. Continuation in a doctoral program is contingent on the availability of a major professor.

The supervisory committee must verify the writing competency of each doctoral student. The method of competency verification is determined by the committee and/or department.

The student and all committee members are required to sign a Data and Copyright form and a Plans for Publication form. The forms are given to the student with his or her copy of the approved supervisory committee form and must be submitted by the student to the Graduate School Office with the Program of Study.

When the supervisory committee has determined the required courses (by the end of the third quarter), the student should submit a **Program of Study** to the School of Graduate Studies. Verification of the student’s writing competency is included on the **Program of Study** form.

Some departments administer qualifying examinations. Each department has the responsibility of administering comprehensive examinations.

Following completion of all or most courses, successful completion of comprehensive examinations, and approval of a proposal for dissertation research, and at least three months before the final defense, the student must submit an **Application for Candidacy** form to the Graduate School Office, along with a copy of the dissertation proposal, signed by all members of the supervisory committee. Submission of the candidacy form is a major step in the student’s program because the committee and department head thereby attest that the student is ready to conduct independent dissertation research, although successful completion of that requirement is not guaranteed.
Credit Requirement. The minimum requirement for a doctoral degree is 90 approved graduate credits in addition to a master's degree or 135 approved graduate credits with no master's degree. Coursework cannot be used for more than one degree. A minimum of 18 dissertation credits is required for a post-master's doctorate and a minimum of 27 for a no-master's doctorate. For the PhD, a minimum of 48 USU credits is required. At least four quarters, three of which must be consecutive, of full-time registration in residence at USU are required. For the EdD, a minimum of 60 USU credits is required. At least five quarters must be full-time registration in residence at USU; none of the quarters need to be consecutive, but three full-time quarters must be taken on campus prior to dissertation credit. Some departments also have language requirements.

With the approval of the supervisory committee and the graduate dean, graduate credit may be transferred from accredited graduate schools, provided the minimum residency requirements are met and the credit has not been used for any other degree. The eight-year (or six-year) time limit for coursework applies to transfer credit. Transfer credits will be shown on official USU transcripts at completion of the degree.

Preparation and Approval of Theses, Plan B Papers, and Dissertations

Before beginning work on a thesis, Plan B paper, or dissertation, a student should obtain the Publication Guide for Graduate Students, available at cost from the Bookstore, and the style manual or journal approved by the supervisory committee and/or department. These documents will guide the student in the proper preparation of his or her manuscript. Theses and dissertations may be prepared in either traditional or multiple-paper format. One article or article-manuscript may not be submitted as a thesis or dissertation.

Preparation of a thesis, Plan B paper, or dissertation is the culminating learning experience for a graduate student. The quality of the product, which should represent the student's own best work, is the responsibility of the student. Monitoring the quality of the thesis, Plan B paper, or dissertation and mentoring the student in writing are responsibilities of the major professor, with the assistance of the supervisory committee. Editing by anyone other than the major professor and the supervisory committee should be limited to mechanics, such as spelling and grammar.

Drafts of sections should be submitted periodically to the major professor for critique. Committee members should be consulted, especially on sections that involve their special expertise. The School of Graduate Studies thesis coordinator (in Main 130) will review an early draft for format and style.

Oral Examination and Defense. The final oral examination should be scheduled by the student after all courses and the thesis, Plan B paper, or dissertation are completed, but at least six weeks before the student's anticipated program completion date. Changes in the membership of a supervisory committee cannot be made during the six weeks prior to the final exam without a written request from the department head and approval of the graduate dean.

At least four weeks prior to the exam, the student shall give a copy of the thesis, Plan B paper, or dissertation to each member of the supervisory committee for approval or corrections. An Appointment for Examination form must be completed by the student and committee, indicating approval of the proposed time and place for the examination and defense, and submitted by the student to the Graduate School Office a minimum of five working days prior to the exam.

No committee member should agree to proceed with a defense until he or she has carefully read and approved the thesis, Plan B paper, or dissertation. If any member of a committee believes that the document is not ready to be defended, he or she should notify the student and major professor and not sign the Appointment for Examination form. The defense should then be rescheduled.

The oral examination of the thesis, Plan B paper, or dissertation is a defense of the final document. Only minor changes, usually editorial, should be required following the defense. If major changes are required, a defense of the revised document should be held.

The chairperson of the examination is appointed by the graduate dean. At the examination, the student defends his or her thesis, Plan B paper, or dissertation and answers questions about the area of specialization. The results of the exam and any additional requirements are recorded on the Record of Examination Completion form. The form is submitted to the Graduate School Office.

All members of the supervisory committee must approve and sign the thesis, Plan B paper, or dissertation. In the event of conflict, the matter is taken to the dean of the School of Graduate Studies.

Any final examination held without following the proper procedures is invalid. Graduate students failing to complete all degree requirements within one year of a successful defense will be required to redefend. Students must register for 3 credits the quarter of redefense.

The final committee-approved and signed thesis or dissertation must be submitted to the thesis coordinator in the Graduate School Office at least four weeks before the anticipated program completion date. The student is responsible for proofreading the thesis/dissertation and having it read and approved by the departmental reviewer before submitting a final draft to the thesis coordinator. The thesis coordinator will review the paper for proper format and conformity to departmental and School of Graduate Studies standards and will also check to make sure it is well-written and neatly typed and that grammar, punctuation, spelling, and other writing mechanics are correct. The coordinator will attach a check sheet listing format problems and instructions for correcting them and will mark examples of needed stylistic and mechanical changes on the paper.

Format corrections and required rewriting must be completed before the thesis coordinator will submit the thesis or dissertation to the graduate dean for approval and signature.

The graduate dean examines each thesis and dissertation before approving and signing it. Any may be selected for further review by members of the faculty not on the student's supervisory committee or by expert reviewers at other institutions before being accepted by the dean.
Final Steps
At the defense or final examination, the student will be given the following forms:

1) Graduation Fee Payment Form—$15
2) Commencement Data Card
3) Binding Fee Card—$20 for the required two copies and $10 for each additional copy. (The student is responsible for all copying costs.)
5) Survey of Earned Doctorates, if a doctoral student
6) Questionnaire for Hometown News Release—optional
7) Alumni Card

Fees must be paid at the Cashiers Office, and the forms completed and submitted to the Graduate School Office, before degree requirements are considered completed.

In addition, two copies of the thesis/dissertation and one additional copy of the title page and an abstract for UMI (150-word maximum for theses and 350-word maximum for dissertations) must be turned in to the School of Graduate Studies for binding and microfilming.

The final committee-approved Plan B paper must be taken to Special Collections in the Merrill Library to be microfiched. Special Collections personnel will provide a paper-receipt that must be submitted to the Graduate School Office before the degree is considered completed.

Also, incomplete grades must be removed from the student’s record by the major professor using forms provided by the Admissions and Records Office. For nonthesis master’s programs, the Graduate School Office must receive a letter of completion from the department head or interdepartmental program director. It is the student’s responsibility to make sure that these final steps are taken.

Diplomas and Commencement
Diplomas are ordered by the registrar’s office at the end of each quarter, except spring quarter, for students who complete within the quarter. For spring quarter, diplomas will be ordered after the Commencement deadline for those students completing before that deadline, and they will be available immediately after the Commencement ceremony, unless they are being held for spring quarter grades, unpaid fees, or unmet requirements. If a student needs verification of completion of a degree before the diploma arrives, the registrar will provide a Certificate of Completion, which is official. The actual date of completion is usually the date the thesis coordinator approves a thesis/dissertation or the date a departmental letter of completion is received by the School of Graduate Studies. The completion date for students who complete their degree requirements during spring quarter but after the Commencement deadline will be the Monday after Commencement, and their diplomas will be ordered at the end of summer quarter.

Only students completing degrees by the published Commencement deadline date for a given year will be included in the official Commencement program for that year, although other students who complete requirements by a later date during spring quarter, established by the graduate dean, may participate in the ceremony. The School of Graduate Studies will provide information concerning the Hooding and Commencement programs to all completed students who indicate interest in attending.
Course Prefixes

Acctg—Accounting
ADVS—Animal, Dairy and Veterinary Sciences
Agr—College of Agriculture
AgSat—Agriculture Satellite
AI—American Institutions
Anthr—Anthropology (Sociology, Social Work and Anthropology Department)
Art—Art
AS—Aerospace Studies
ASTE—Agricultural Systems Technology and Education
BA—Business Administration
BIE—Biological and Irrigation Engineering
Bio—Biology
Bimet—Biometeorology (Plants, Soils, and Biometeorology Department)
BIS—Business Information Systems and Education
Bot—Botany (Biology Department)
CEE—Civil and Environmental Engineering
Chem—Chemistry and Biochemistry
Com D—Communicative Disorders and Deaf Education
Comm—Communication (Journalism)
CS—Computer Science
DE—Dance Education (Health, Physical Education and Recreation Department)
DE P—Dance Education—Professional (Health, Physical Education and Recreation Department)
Econ—Economics
Educ—College of Education
ECE—Electrical and Computer Engineering
El Ed—Elementary Education
Engl—English
Engr—General Engineering
Ent—Entomology (Biology Department)
FHD—Family and Human Development
FL—College of Family Life
FR—Forest Resources
FW—Fisheries and Wildlife
Geog—Geography (Geography and Earth Resources Department)
Geo—Geology
HASS—College of Humanities, Arts and Social Sciences
H Env—Human Environments
HE P—Health Education—Professional (Health, Physical Education and Recreation Department)
Hist—History
Honor—Honors Courses
HU—Humanities and Arts
IELI—Intensive English Language Institute
Ins T—Instructional Technology
IO—Integrative Option
ITE—Industrial Technology and Education
LAEP—Landscape Architecture and Environmental Planning
L Arb—Languages (Arabic)
L Ch—Languages (Chinese)
L Fr—Languages (French)
L Gk—Languages (Greek)
L Gr—Languages (German)
L It—Languages (Italian)
L Jp—Languages (Japanese)
L Ko—Languages (Korean)
L Lin—Languages (Linguistics)
L Ln—Languages (Latin)
L Po—Languages (Portuguese)
L Ru—Languages (Russian)
L Sp—Languages (Spanish)
LAS—Liberal Arts and Sciences
LS—Life Science
Math—Mathematics (Mathematics and Statistics Department)
MAE—Mechanical and Aerospace Engineering
MHR—Management and Human Resources
Micro—Microbiology (Biology Department)
MS—Military Science
Music—Music
NFS—Nutrition and Food Sciences
NR—Natural Resources
PE—Physical Education (Health, Physical Education and Recreation Department)
PE P—Physical Education—Professional (Health, Physical Education and Recreation Department)
Phil—Philosophy (Languages and Philosophy Department)
Phys—Physiology (Biology Department)
Phyx—Physics
PL Sci—Plant Science (Plants, Soils, and Biometeorology Department)
PolSc—Political Science
PR P—Parks and Recreation—Professional (Health, Physical Education and Recreation Department)
PS—Physical Science
PSB—Plants, Soils, and Biometeorology
Psy—Psychology
Pub H—Public Health (Biology Department)
RE—Recreation Courses (Health, Physical Education and Recreation Department)
RR—Recreation Resources (Forest Resources Department)
RLS—Rangeland Resources
SecEd—Secondary Education
SK—Learning Skills
Soc—Sociology (Sociology, Social Work and Anthropology Department)
Sp Ed—Special Education and Rehabilitation
Soils—Soil Science (Plants, Soils, and Biometeorology Department)
Spch—Speech (Languages and Philosophy Department)
SS—Social Science
Stat—Statistics (Mathematics and Statistics Department)
SW—Social Work (Sociology, Social Work and Anthropology Department)
ThArt—Theatre Arts
WC—Written Communication
WS—Watershed Science
Zool—Zoology (Biology Department)
Interdepartmental Curricula

Interdepartmental

Concurrent Degrees

Students may pursue concurrent master's degrees or master's and doctoral degrees with the approval of cooperating departments and the graduate dean.

Guidelines for Concurrent Master's Degree Programs. In special cases, a student may complete concurrently the requirements for two master's degrees in different departments but with fewer than the total credits required by both programs, provided that the following conditions are met:

1. The student must formally apply, be accepted into both programs, and pursue the degrees concurrently;

2. The chairperson of the student's supervisory committee in each department must also be a member of the other committee;

3. The supervisory committee, the two department heads, and the graduate dean must approve the course of study for each degree;

4. There can be a maximum of 12 credits of overlap in courses between the two degree programs, and the overlap must be in the elective or broadening courses. With the allowance of overlapping, a student could thus complete the requirements for both degrees with up to 12 fewer credits than the usual minimum total for two degrees.

Guidelines for Concurrent Doctoral-Master's Degree Programs. In special cases, a student may complete concurrently the requirements for a doctorate and a master's degree in different departments with fewer than the total credits required by both programs, provided that the following conditions are met:

1. The student must formally apply, be accepted into both programs, and pursue the degrees concurrently.

2. The student's doctoral supervisory committee must consist of four members from the doctoral department and two members from the master's department if the student is on a thesis plan. The master's committee must consist of the two master's departmental members and the chair of the doctoral committee.

3. The student's supervisory committee, the two department heads, and the graduate dean must approve the course of study.

4. There may be a maximum of 21 credits of overlap in courses between the two degree programs, and the overlap must be primarily in the elective or broadening courses. With the allowance of overlapping, a student could thus complete the requirements of both degrees with a minimum of 114 credits rather than the usual 135 minimum.

Interdepartmental Doctoral Program in

Education (EdD, PhD)

Chairman: Dean Izar A. Martinez, College of Education
Office in Emma Eccles Jones Education 109, 797-1437

Faculty: Faculty are listed with participating departments

Degrees offered: Doctor of Education (EdD) and Doctor of Philosophy (PhD) with areas of specialization

Areas of specialization: Business Information Systems and Education, Curriculum and Instruction, Instructional Technology, Research and Evaluation

The College of Education offers an interdepartmental program of studies leading to the EdD or PhD.

The Doctorate of Education (EdD) degree program is intended for students who wish to be better prepared to understand and deal effectively with curricular and instructional problems as administrators, supervisors, and curriculum specialists in public or private educational institutions and settings. The EdD is also for students intending to teach in community and four-year colleges.

The Doctor of Philosophy (PhD) degree program is intended for students who wish to be better prepared to fulfill roles as college and university researchers and teachers in education and education-related fields. The PhD is also designed for students planning to conduct and direct research and development activities in public or private educational agencies or in the corporate sector.

Participating departments include Business Information Systems and Education, Communicative Disorders
and Deaf Education, Elementary Education, Instructional Technology, Secondary Education, and Special Education and Rehabilitation. The PhD and EdD both require 27 hours of dissertation credit. By careful planning, related certification requirements can often be met through a program of studies leading to either the EdD or PhD.

Admission Requirements

Admission to the program requires (1) a master's degree or equivalent coursework related to a specialization, (2) GRE verbal and quantitative scores at or above the 40th percentile, (3) a teaching certificate and two years of teaching experience or their equivalents, and (4) demonstrated writing proficiency.

Specializations

Students may select an area of emphasis of research and study from the following specializations:

1) Business Information Systems and Education (business information systems and communication, business and/or vocational education, marketing and economic education, and training and development);

2) Curriculum and Instruction (educational audiology, mathematics/science, reading/writing, social studies, or instructional leadership);

3) Instructional Technology (instructional design, evaluation, systems analysis, interactive learning technologies, or alternative instructional and training strategies);

4) Research and Evaluation (evaluation of the quality of educational programs, including the comparison of strengths and weaknesses of alternative programs; the revision, updating, and/or redirection of existing programs; and the analysis of related educational issues).

Degree Requirements

Each EdD or PhD student must complete the following Unifying Program of Studies courses: Educ 601, 660, 661, 667, 730, and 731. Educ 767 is required in the PhD program. In addition, each area of specialization specifies a core of required and elective courses related to the emphasis of study within the specialization.

Residency

The Doctorate of Philosophy (PhD) degree requires four quarters of residency, with a minimum of three quarters of consecutive residency. Completion of 45 credits in residence on the Logan campus is required.

The Doctorate of Education degree (EdD) requires an additional quarter of full-time residency, for a total of five quarters, but those quarters need not be consecutive. However, at least three of the quarters of full-time coursework must be taken on campus prior to registering for dissertation credit.

Research

Each student must complete a significant research study and prepare an article for publication in an appropriate journal based on the completed research and/or program of study.

Financial Assistance and Assistantships

Departmental, grant, and other financial support is available on a competitive basis. Students desiring financial support should contact their department of affiliation or the dean of the College of Education prior to January 1.

Career Opportunities

The doctoral specializations prepare educational leaders for positions in curriculum and instructional program development, supervision, consulting, public school and university teaching, human services, research and evaluation, and a variety of other careers.

For more information, write to the Dean, College of Education, Utah State University, Logan, Utah 84322-2800 or to the heads of the participating departments.

Education Courses

500H. Senior Honors Seminar. For students in the College of Education to explore an honors interdisciplinary theme selected by the Honors Committee as a culmination of an Honors experience. (3Sp)

556. Practice in Improving School System Programs. Seminar focused upon different phases of the instruction program and upon new and persisting problems in teaching. (1-6)


608. The School Principalship—Elementary, Middle, and Secondary. Emphasis will be on the management and leadership function of the principal in improvement of instruction, curriculum development, communication, and student/teacher personnel administration. (3Su)

610. Theories of Instructional Supervision. Principles and theoretical base of supervision as they relate to improving instructional practices. Research findings and recommended practices will be emphasized. (3Su)

624. The American College Student and Higher Education. Reviews impact of college on students. Describes, analyzes, and details research on college students covering the past 40 years. (3Su)

625. Student Personnel in Higher Education. acquaints students with the history, development, and scope of student personnel services in higher education. Introduces students to the "Personnel Point of View." (3W)

641. Social, Cultural, and Philosophical Foundations of Education. Relationship of the modern school to society, with special emphasis upon social, cultural, and philosophical literature having influence in giving direction to American education. (3W, Su)

654. Organization and Control of Public Schools. The organization of local, state, and national educational units, their control and influence, and the role of educational leaders functioning within these units will be studied. (3Su)

656. Practicum in the Improvement of Instruction. Field-based program focused upon effective teaching methodologies, teaching performance, curriculum decision making, value guidelines, and characteristics of the learner. (1-6)

660. Correlation and Regression in Psychology and Education. Various bivariate correlational techniques, partial correlation, introduction to multiple regression and factor analysis. Prerequisite: Psy 380. (3F, Sp)

661. Inferential Statistics in Psychology and Education. Hypothesis testing, critical ratios, and t-tests; analysis of variance and covariance, simple and complex; nonparametric statistics. Prerequisite: Psy 380. (3W, Sp)

666. Research for Classroom Teachers. Assists teachers in applying research methods to classroom problems, in locating, interpreting, and using research reports, and in writing research-related papers on teaching. (3W, Sp, Su)

667. Introduction to Educational and Psychological Research. Identifying a research problem, reviewing and evaluating the research lit-
Sensitivity to the legal, ethical, social, technological, and international forces in the business environment. The MBA program is designed to provide understanding and analytical tools necessary for effective and efficient management in today's complex business world. The curriculum prepares the student with a working knowledge of the fundamental business functions, and a sensitivity to the legal, ethical, social, technological, and international forces in the business environment.

MBA program is directed to develop the analytical, communication, interpersonal, and leadership skills needed for a successful career in a variety of organizations. The MBA program is accredited by the American Assembly of Collegiate Schools of Business (AACSB).

Admission to the MBA program is open to qualified graduate students regardless of their undergraduate major.
Whether the student enters the one- or two-year program depends on the undergraduate program. The two-year program is designed for those with undergraduate degrees in disciplines other than business and consists of approximately 90 credits. The entire outlined two-year program may not be required if the student has taken the appropriate coursework. Before entering the program, each student should meet with an adviser to plan his or her course of study. The one-year program is for those with undergraduate degrees in business and consists of a minimum of 45 credits. The one-year program is the same as the second year of the two-year program.

Admission Requirements
See general admission requirements on pages 25-26. In addition, the student desiring to pursue the MBA degree must have been accepted as a matriculated student before he or she will be permitted to register for any 600-level courses that will be part of the student's advanced program. Scores on the Graduate Management Admission Test (GMAT) are required of all applicants. Full-time business experience is also preferred. Personal interviews with faculty representatives are encouraged.

Students without an undergraduate degree in business are accepted any quarter, and applications are due 90 days before the quarter begins. Students with such a degree are accepted for summer and fall quarters and must apply by March 1 and April 15, respectively.

Degree Requirements
The first-year curriculum (basic program) provides skills and knowledge in statistics, written communication, computer literacy, mathematics, information systems, economics, accounting, finance, marketing, management, and organizational behavior. Students may not be required to take courses which duplicate prior academic or industrial training, with the approval of the director of the MBA program. Students who have completed a bachelor's degree at another university must have coursework equivalent to the core subject matter areas of the American Assembly of Collegiate Schools of Business for direct entry into the advanced program.

The advanced program requires a minimum of 45 credits. Since the MBA develops broadly trained managers, the coursework in the advanced program is divided into the following eight categories to ensure breadth. Courses within these categories cover many areas, including leadership skills, top-management strategic planning, information systems, marketing, finance, production, and organizational behavior.

1. Quantitative Methods. Select either Stat 605 or Econ 633.

2. Functional Areas of Business. The following courses are required: BA 642, 652, 672; and MHR 681.

3. Planning and Control. Select either Acctg 635 or MHR 686.

4. Information Systems. BIS 670 is required.

5. Interpersonal Effectiveness and Leadership. Select either MHR 665 or 666.

6. Professional Paper. While completing Acctg 696, BA 696, or MHR 696, each student must prepare a paper of professional quality demonstrating the ability to complete one of the following: (1) business plan, (2) business consulting project, (3) marketing research project, (4) behavioral survey project, or (5) individual project.

7. Management Strategy. MHR 689 is required.

8. Specialization or Electives. Eight to thirteen credits are chosen from a wide variety of approved 600-level courses.

The following courses may also be required: BA 635, MHR 662, 683.

Options for advanced-program research are (1) thesis, using BA 697 (9 credits maximum) or (2) one of the options under Acctg, BA, or MHR 696. If the student elects to do a professional paper (Acctg, BA, or MHR 696), the activity is directed by the class instructor rather than by a supervisory committee.

Financial Assistance and Assistantships
Graduate assistantships, scholarships, and fellowships are available to outstanding students. Graduate assistantships and scholarships are available and generally range between $1,000 and $3,000 for nine months. Application for assistantships must be made by April 1. A recipient of a graduate appointment is usually eligible for a waiver of the out-of-state portion of his or her tuition.

MBA Courses
The course numbers and titles for courses included in the MBA program are listed below. For course descriptions, number of credits, and quarters taught, see course listings under individual departments.

Accounting
601, 602. Accounting for Management Control
635. Advanced Managerial Accounting
696. Professional Paper

Business Information Systems
615. Communications for Business
630. Database Management Systems
670. Information Systems Resource Management

Business Administration
607. Survey of Corporation Finance
608. Survey of Marketing
635. Managerial Economics
642. Finance Problems
644. Special Topics in Finance
645. Investment Theory
652. Marketing Strategy
654. Special Topics in Marketing
672. Operations Management
674. Special Topics in Operations Management
690. Independent Research and Reading
696. Professional Paper
697. Thesis
699. Continuing Graduate Advisement

Students who majored in business as undergraduates are not required to take the advanced course in the area of their undergraduate major.
Economics
633. Applied Econometrics

Management and Human Resources
600. Survey of Business Law
609. Survey of Management and Organizational Behavior
655. Staffing Organizations
661. Human Resource Planning and Performance Appraisal
662. Human Resources Management
663. Compensation Administration
664. Selected Topics in Management and Human Resources
665. Interpersonal Effectiveness in Management
666. Organizational Leadership, Influence, and Change
667. Labor Relations

Interdepartmental Program in

Ecology

Director: Associate Dean Frederic H. Wagner, College of Natural Resources
Office in Natural Resources 110B
Administrative Office in Natural Resources 314, 797-2555

Degrees offered: Master of Science (MS) and Doctor of Philosophy (PhD) in the following departments: Biology; Fisheries and Wildlife; Forest Resources; Geology (MS only); Plants, Soils, and Biometeorology; and Rangeland Resources

The ecology program at Utah State University is administered by the interdepartmental Ecology Center. Its goals are to promote research and graduate education in the science of ecology and to provide expert, professional information and advice for decision makers considering actions that affect the environment. The research carried out by the center’s associates covers the full spectrum of ecology on several continents, but most of it is centered in the montane and desert regions of the western United States.

Students earn their degrees in ecology while maintaining residence in one of the participating departments; the center itself does not grant degrees. The candidate selects and is assigned a major professor from the department appropriate to his or her interests.

Degree Requirements

Requirements for graduate degrees in ecology include the University and departmental degree requirements, as well as the Ecology Center requirements outlined below, which are formulated by the Ecology Center Faculty Advisory Committee. This committee is comprised of faculty representatives, designated by the respective department heads, from the departments of Biology; Fisheries and Wildlife; Forest Resources; Geography and Earth Resources; Geology; Plants, Soils, and Biometeorology; and Rangeland Resources. The Ecology Center director chairs the committee.

The ecology MS and PhD are research degrees requiring a research thesis or dissertation. The following course requirements for each of these degrees fall into two categories. The first is a general science category. Students receiving graduate degrees in ecology are expected to have some breadth and sophistication in modern science. The second category includes ecology course requirements. These are for the most part general requirements, with the specific courses taken by each student selected by his or her graduate committee and tailored to his or her needs and professional goals.

Ecology MS and PhD Degrees General Science Requirements

Mathematics, Chemistry, Physics, and Computer Science

By its very nature, ecology must draw upon knowledge from most branches of science. As a result, at least a reasonable facility with fundamental mathematics and physical sciences must be attained by students, since these concepts have expression throughout the sciences. In order to assure a minimal comprehension in these areas, students receiving graduate degrees in ecology are required to have had the following at some point in their university careers:

1. Equivalent of mathematics through two quarters of calculus.
2. Equivalent of at least a one-quarter overview course in physics.
3. Chemistry through organic.
4. One year of introductory statistics and one graduate-level statistics course.
5. Some facility with one of the following computer programming languages: BASIC, C, FORTRAN, LISP, PASCAL, or PROLOG.

These courses are the minimum requirements for the MS and PhD degrees. The committee strongly recommends developing greater facility by taking at least a full year of calculus; one or more courses from the set of three including linear algebra, differential equations, and multi-variable calculus; and a full year of professional-level physics.

Biology

The following are required of all ecology graduate students, and must be taken at some point during their university career:

1. Equivalent of mathematics through two quarters of calculus.
2. Equivalent of at least a one-quarter overview course in physics.
3. Chemistry through organic.
4. One year of introductory statistics and one graduate-level statistics course.
5. Some facility with one of the following computer programming languages: BASIC, C, FORTRAN, LISP, PASCAL, or PROLOG.

These courses are the minimum requirements for the MS and PhD degrees. The committee strongly recommends developing greater facility by taking at least a full year of calculus; one or more courses from the set of three including linear algebra, differential equations, and multi-variable calculus; and a full year of professional-level physics.

Biology

The following are required of all ecology graduate students, and must be taken at some point during their university career:
1. Genetics or evolution, one course.
2. One course in animal physiology for students emphasizing animal ecology.
3. One course in plant physiology and soils for students emphasizing plant ecology.

**Ecology Course Requirements**

The following requirements prevail in early 1995 as this catalog is going to press. However, the Ecology faculty is revising the requirements to have them in place by fall 1995 or early 1996. Students entering the program before the curriculum change will fulfill the requirements shown here. Students entering after the change will follow the new curriculum. Upon arrival, incoming students should check with their major professors to determine which requirements they will be expected to follow.

**Master of Science**

1. Attendance in Ecology Seminar (Biol 687, FW 687, FR 687, or RLR 687) is required each quarter in residence.
2. One course each in organismal, population, and community or ecosystem ecology and in abiotic environment (total of four courses) is required. See the following list for the approved courses in each of these categories.

**Doctor of Philosophy**

1. Attendance in Ecology Seminar (Biol 687, FW 687, FR 687, or RLR 687) is required each quarter in residence.

**Courses Meeting Degree Requirements by Category**

**Abiotic Environment.** Bimat 630, 635, 650; CEE 562, 660; FR/Soils 628; Geol 360; Micrb/Soils 635; Soils 562, 605, 613, 614, 619, 655, 665, 672, and 727; WS 549.

**Organismal Ecology.** Biol 642; Bot 612; Ent 639; FW 320, 605, and 610; Physl 605; RLR 615, 715.

**Population Ecology.** Biol 525, 630; Ent 534, 540, 634; FW 623, 630; FR 665; RLR 730.

**Community and Ecosystem Ecology.** Biol 632, 642; Biol/NR 576, 577; FW 460, 462, 655, 661, 685, 690; FR 670, 671; Geol 636; Micrb 530, 560; RLR 507, 522, 541, 561, 642, 655, 742; Zoal 580.

**Interdepartmental Program in Environmental Engineering**

**Chairman: Professor Ronald C. Sims**, Department of Civil and Environmental Engineering
Office in Engineering Laboratory 225, 797-2926

The Division of Environmental Engineering is an interdisciplinary undergraduate- and graduate-level division providing service to faculty and students of departments within the College of Engineering (Civil and Environmental, Mechanical and Aerospace, Electrical and Computer, and Biological and Irrigation) and the departments of Biology, Plants, Soils, and Biometeorology; and Chemistry and Biochemistry. The principal objective of the Division of Environmental Engineering is to prepare a graduate to be well informed about environmental problems and capable of developing solutions to those problems.

The graduate program includes students with undergraduate degrees in engineering, chemistry, biology, microbiology, mathematics, and other disciplines associated with public health and a quality environment. However, students without undergraduate engineering backgrounds must complete background courses in mathematics, statics, dynamics, hydrology, engineering economics, fluid mechanics, and hydraulics. Generally, students with a nonengineering background require two years to complete an MS degree. All students are required to complete a set of core environmental engineering courses, and the remainder of the student's program is comprised of interdisciplinary, interdisciplinary courses approved by the student's supervisory committee.

The undergraduate program is interdisciplinary in structure with a focus on multimedia aspects of environmental control and management. Two schedules (four-year and five-year) have been developed for completion of the program.

Particular emphasis within the division has been placed on the development of an integrated, multidisciplinary approach to environmental quality education and research by involving students and faculty from pertinent disciplines associated with environmental quality. Flexibility in developing a program tailored to a student's personal professional goals is basic to the philosophy of the interdisciplinary program at the graduate level.

The program is currently supported, in part, by Utah Water Research Laboratory research assistantships, University research assistantships, teaching assistantships, and by U.S. Government and private industry grants.
Interdepartmental Specialization in

Molecular Biology

Director: Professor Joseph K. K. Li, Department of Biology
Office in Veterinary Science Building 323, 797-1914

Professors: Anne J. Anderson, Biology; Steven D. Aust, Chemistry and Biochemistry; Roger A. Coulombe, Jr., Animal, Dairy and Veterinary Sciences; Linda S. Powers, Electrical and Computer Engineering; William H. Scouen, Chemistry and Biochemistry; Jon Y. Takemoto, Biology; Reed P. Warren, Biology; Associate Professors: John G. Carman, Plants, Soils, and Biometeorology; Noelle Cockett, Animal, Dairy and Veterinary Sciences; Gregory J. Podgorski, Biology; Dennis L. Welker, Biology; Assistant Professors: Danny J. Blubaugh, Chemistry and Biochemistry; Scott A. Ensign, Chemistry and Biochemistry; Lance C. Seefeldt, Chemistry and Biochemistry; Paul G. Wolf, Biology; Research Associate Professor: John D. Morrey, Animal, Dairy and Veterinary Sciences; Research Assistant Professors: Thomas A. Grover, Chemistry and Biochemistry; Joanne E. Hughes, Biology; Martin G. Klotz, Biology; Anuradha Singh, Biology

Degrees offered: Master of Science (MS), Doctor of Philosophy (PhD) specialization in cooperating departments

The program brings together faculty and students interested in molecular biology. Faculty associated with the program are from the Interdepartmental Curriculum in Toxicology and from the departments of Biology, Chemistry and Biochemistry; Animal, Dairy and Veterinary Sciences; Electrical and Computer Engineering; and Plants, Soils, and Biometeorology.

The MS and PhD degrees with specialization in molecular biology are offered through participating departments. Current degrees are animal, dairy and veterinary sciences/molecular biology, biology/molecular biology, biochemistry/molecular biology, plant science/molecular biology, toxicology/molecular biology, and nutrition and food sciences/molecular biology. Students must be admitted both to the Molecular Biology Program and to a participating department, and must meet the degree requirements of both the department and the program. All students in Molecular Biology must complete a core curriculum that consists of Biol 519 and 621 and Chem 672.

Interdepartmental Program in

Social Sciences

Degree Coordinator: Dean Brian L. Pitcher, College of Humanities, Arts and Social Sciences
Office in Main 131, 797-1195

Degree offered: Master of Social Sciences (MSS)


Administration

The program is administered by a committee of the department heads (Management Committee) from the four major disciplines or their designees. The committee is chaired by annual rotation by one of the members of the committee, and reports to the Degree Coordinator. The Management Committee reviews policy and develops recommendations which are submitted to the Degree Coordinator for approval.

Degree Description

The social sciences are disciplines that have as a common objective the understanding of human behavior and social relationships. The MSS offers multidisciplinary graduate training for candidates desiring an in-depth applied understanding of human performance, human environments, and/or the structuring of social, political, and economic systems. There are Plan B and Plan C options in the MSS Program. Students in Economics, History, and
Sociology typically follow the Plan B option, while Human Resource Management students typically follow the Plan C option. The Plan B option requires a minimum of 48 credits and the Plan C option requires a minimum of 51 credits. Both options require a minimum of 24 credits in a major discipline plus (a) a minimum of 12 credits in each of two minors, or (b) a minimum of 12 credits in a minor and a minimum of 12 credits in a cluster. Courses counted in a cluster must be outside of the selected major and minor. Three of the 48 credits required for the Plan B option must be thesis credits, but no more than 3 credits of thesis can be counted toward a degree. Plan C requires 51 credits of coursework with no thesis credit allowed. Departments may impose more rigorous requirements. A maximum of 3 credits may be earned either from readings/conferences or from independent research.

The MSS degree is primarily intended to prepare degree recipients for employment or advancement in social science-related occupations. Students interested in pursuing doctoral work should consider a Plan A Master of Science program.

Admission Requirements
See general admission requirements, pages 25-26. In addition, the faculty of each discipline determines whether to recommend to the graduate dean the acceptance of applicants. For further information, please contact the Graduate Coordinator in the department of the proposed major.

Specializations
Program specializations and emphases and the qualifications for each are summarized below.


History. The MSS in History is designed for secondary teachers who want more training to certify in additional teaching fields. Acceptable minor fields include Instruc­tional Technology, Economics, Geography, Political Science, Psychology, and Sociology/Anthropology.

Human Resource Management. Human Resource Management deals with those processes that provide, develop, and maintain a productive workforce in a dynamic and changing environment. Subject areas include human resource planning; recruiting; selection; placement; compensation and benefits; performance management; career planning, training, and development; labor relations; and ethical/legal employment practices. Individuals interested in a general management program are referred to the College of Business MBA Program.

Sociology. The Sociology Program offers coursework in sociological theory and methods/statistics and has four emphases: Sociology of Development, Demography, Social Problems, and Environmental Sociology. The MSS specialization in Sociology is well suited to individuals with interdisciplinary interests that include one of these areas of departmental strength. International Rural and Community Development is a currently well-developed option within the Sociology of Development emphasis. Other options may be arranged in consultation with the student’s supervisory committee.

Degree Requirements
Student Supervision. For each student admitted, a supervisory committee is ordinarily appointed consisting of at least one faculty representative from the student’s major discipline and (a) one from each of the minor disciplines, or (b) one from a minor discipline and one from a discipline associated with the cluster.

Plan C Culminating Experience. Each major discipline has an integrative requirement toward the end of the student’s program for the Plan C option. The requirement may include a comprehensive examination, a capstone course, and/or an integrative project.

Plan B Research Paper. Each Plan B student must submit a research paper for thesis credit in accordance with School of Graduate Studies and department requirements. Ordinarily, the Plan B paper is written in the major discipline, but in some cases, with the approval of the student’s supervisory committee, it may be written in one of the minor disciplines. Information specific to each major discipline may be obtained by contacting the sponsoring department.

Further Information
Candidates interested in pursuing this degree program may obtain specific information by contacting the head of one of the participating departments, the School of Graduate Studies, or the Dean of Humanities, Arts and Social Sciences.
Interdepartmental Program in

Toxicology

Acting Director, Center for Environmental Toxicology, Associate Professor Howard M. Deer, Department of Animal, Dairy and Veterinary Sciences
Office in Animal Science 205, 797-1600

Professors Anne J. Anderson, plant toxicology; Steven D. Aust, biochemical toxicology; William A. Brindley, insecticide toxicology; Carl D. Cheney, behavioral toxicology; Roger A. Coulombe, Jr., biochemical and genetic toxicology; Ronald C. Sims, environmental engineering; Reed P. Warren, immunologic basis of toxic injury; Adjunct Professor Lynn F. James, poisonous plant toxicology; Associate Professors Howard M. Deer, pesticides and occupational health; William J. Doucette, fate of chemicals in the environment; David B. Drown, industrial hygiene; R. Ryan Dupont, biological waste treatment; Michael J. McFarland, hazardous waste management; Research Associate Professor Darwin L. Sorensen, aquatic toxicology; Adjunct Associate Professors Kip E. Panter, poisonous plants; James A. Pfieter, behavioral toxicology of range plants; Assistant Professor Ann E. Aust, chemical carcinogenesis; Research Assistant Professor Thomas A. Grover, macromolecular mechanisms

Degrees offered: Master of Science (MS) and Doctor of Philosophy (PhD) in Toxicology

Specialization: Molecular Biology

Basic and applied research and study in toxicology is interdisciplinary and interdepartmental, with emphasis on environmental aspects. Students may affiliate with the program through the departments of Animal, Dairy and Veterinary Sciences; Biology; Chemistry and Biochemistry; Nutrition and Food Sciences; Psychology; Civil and Environmental Engineering; or Fisheries and Wildlife. The Biotechnology Center, Ecology Center, Utah Agricultural Experiment Station, Animal Behavior Institute, Utah Water Research Laboratory, and USDA laboratories on the campus also provide facilities and research projects for study. A program in toxicology/molecular biology is available.

Admission Requirements

Students with a bachelor's degree in life sciences, physical science, medical science, or engineering and adequate preparation in chemistry, biology, physics, and/or mathematics are eligible. Admission to the program requires approval of the professors and compliance with the general admission requirements of the University (see pages 25-26).

Major Research Areas

Biochemical Toxicology. Biochemical toxicology is an important tool in investigating physiological responses in organisms. Specific studies include macromolecular interactions with chemicals including (a) pharmacokinetics and subcellular distribution, (b) enzyme inhibition and kinetics, (c) effects of toxicants upon macromolecular syntheses and metabolic intermediates, and (d) free-radical mechanisms.

Molecular Toxicology. Modern molecular biological techniques are used to determine the mechanisms of carcinogenesis by examining how various natural and synthetic compounds interact with DNA. Resultant mutations on oncogenes and tumor suppressor genes are being investigated, as these are thought to be important in the development of cancer. Retinoid toxicity to the developing fetus is being evaluated through recombinant DNA techniques. Mechanisms by which retinoids regulate gene expression in vivo and in vitro is a current focus of study, and the interaction of retinoid and other signal transduction pathways is being addressed.

Immunotoxicology. Low level exposures to chemicals can alter host resistance to various infections. Projects carried out at Utah State University include studying the mechanisms of toxic impact on the immune system, including detrimental effects of toxicants on various immune cells. Investigations also include mechanisms of these effects, by exploring effects on various lymphokines and their receptors.

Industrial Toxicology. This area includes studies on disposition of chemicals after pulmonary exposure. The systemic effects of chemicals via this route are important in occupational and industrial health. Projects have been carried out using the inhalation mode of exposure for various toxic chemicals. Studies have included the clearance of substances via the pulmonary route, systemic effects of chemicals when organisms are exposed to inhalation insult, and the effect on selected cellular parameters of the pulmonary function.

Carcinogenesis, Teratogenesis, Mutagenesis. The effects of chemical exposure on genetic material are important and often irreversible. These investigations also provide valuable information in predicting long-term effects in a relatively short and inexpensive way. Additionally, the molecular effects of chemical carcinogens and the relationship between carcinogenesis and aging are being investigated.

Natural Product Toxicity and Food Toxicology. People are exposed to roughly 10,000 times more natural toxins in their diets than residues of synthetic or "man-made" toxins, such as residues of pesticides, PCBs, and dioxins. It is now recognized that the risk to animal and human health posed by natural toxins far exceeds that posed by the synthetic variety. Work is ongoing to identify and control the presence of food borne toxicants, as well as to determine their mechanism of action. Studies are in progress to determine the effects of natural compounds present in the environment, including toxic principles in plants and mycotoxins that may affect plant or food materials.
Environmental, Agricultural, and Comparative Toxicology. Studies of how mammals, fish, and insects detoxify foreign compounds and consequences of exposure to xenobiotics have been conducted. Current interests include diversity of mixed-function oxidases or esterases. Induction of these detoxifications and resistance to xenobiotics induced by them are studied.

Biodegradation and Hazardous Waste Management. Basic biological, chemical, and physical methods to reduce the amount and toxicity of hazardous substances are studied. Models are developed and tested for dealing with the migration of chemicals in the environment, especially those for considering potential routes for human exposure.

Interdepartmental Program in Watershed Science

Director: Professor John A. Kadlec, Department of Fisheries and Wildlife
Office in Natural Resources 355B, 797-2461

Professors Allan Falconer, Geography and Earth Resources; Charles P. Hawkins, Fisheries and Wildlife; Associate Professors Roger E. Banner, Rangeland Resources Extension; James P. Dobrowolski, Rangeland Resources; Michael J. Jenkins, Forest Resources; Chris Luecke, Fisheries and Wildlife; G. Allen Rasmussen, Rangeland Resources Extension; Wayne A. Wurtsbaugh, Fisheries and Wildlife; Assistant Professors Todd A. Croul, Fisheries and Wildlife; Joanna Endter-Wada, Forest Resources; Michael P. O'Neill, Geography and Earth Resources; R. Douglas Ramsey, Geography and Earth Resources; Helga Van Miegroet, Forest Resources; Research Assistant Professor Jeffrey L. Kershner, USDA Forest Service; Affiliate Professors David S. Bowles, Utah Water Research Laboratory; J. Paul Riley, Utah Water Research Laboratory; Affiliate Associate Professor Christopher M. Neale, Biological and Irrigation Engineering; Affiliate Assistant Professors Thomas B. Hardy, Civil and Environmental Engineering; Thomas E. Lachmar, Geology; David G. Tarboton, Utah Water Research Laboratory

Degrees offered: Master of Science (MS) and Doctor of Philosophy (PhD)


Watershed Science is an interdepartmental program administered through the Watershed Science Unit in the College of Natural Resources. The program is organized to address challenges in watershed conservation and management, including global climatic change, severely degraded riparian ecosystems, acid precipitation, cumulative effects of land disturbance, and increasing demands for limited natural resources. A basic premise of the USU Watershed Science Unit is that watersheds are fundamental natural resource management units. Program faculty define watershed science as the interdisciplinary study of the physical, chemical, biological, and ecological interactions within a watershed that affect the quantity, quality, and movement of water and other natural resources that depend on water. Participating faculty possess expertise in hydrology; fluvial and hillslope geomorphology; snow dynamics; meteorology; remote sensing; geographic information systems; riparian ecology and management; and stream, lake, and wetland ecology and management.

Degrees

Students can pursue MS and PhD degrees emphasizing hydrology, ecology, or watershed management. The curriculum is interdisciplinary in nature and designed to provide the flexibility necessary to meet student needs and societal demands for natural resource management.

Course Requirements

The following core courses are required: ADVS 635, 660, and 681. Supporting core courses include Chem 670, 671, and 672 (or Biol 621); Physl 501 and 502; and Stat 502 and 503.

Students may choose from the following elective courses: ADVS 640, 682, and 691; and Ent 635.

Additional coursework will be determined by the supervisory committee and depend on the area of emphasis. Approximately one-third of the MS and one-half of the PhD work consist of research necessary to the completion of a thesis or dissertation.

Admission Requirements

Applicants should have a bachelor's degree in a physical, chemical, or biological discipline relevant to their chosen area of emphasis. Appropriate degrees include those in watershed science, water resources, forestry, rangeland resources, aquatic ecology, physical geography, environmental engineering, and interdisciplinary degrees in biological, chemical, or environmental studies. Applicants should have at least two quarters of calculus, a year of both chemistry and biology, and at least one quarter of both physics and statistics. Students without these courses may be admitted but will be expected to make up any deficiencies in addition to completing courses required for the graduate degree. A minimum undergraduate GPA of 3.0 and verbal and quantitative GRE scores at or above the 40th percentile are required. A combined verbal and quantitative GRE score of 1,200 or greater is desired.

Course Requirements

Students will develop individually tailored programs of study with approval of their advisory committees. Coursework will include some or all of the specialty courses listed under Watershed Science in addition to courses offered through Forest Resources, Fisheries and Wildlife, Geography and Earth Resources, Rangeland Resources, Civil and Environmental Engineering, and Mathematics and Statistics.
Watershed Science Courses

515. Fluvial Geomorphology. Broadly examines the movement of water and sediment through stream channels, the erosional and depositional processes associated with this movement, and landforms produced by these processes. Prerequisite: Students must have completed one of the following courses: WS 300, CEE 343, Geol 113, or Geol 111; introductory calculus and physics; or must have obtained permission of the instructor. (4SP)

**545. Disturbed Land Hydrology.** Study of hydrologic concerns associated with drastic land disturbance. Implications of wildland rehabilitation and mined land reclamation treatments to water quality, quantity, and timing will be emphasized. Prerequisite: WS 420 or equivalent. (3SP)

546. Avalanche and Snow Dynamics. Fundamentals of snow dynamics and avalanche forecasting; management of snow in recreational areas. (1-3W)

549 (f449). Small Watershed Hydrology. A detailed exploration of the concepts of small watershed hydrology. Course material will concentrate on recent research findings for examining key hydrological processes. Also listed as CEE 549. (3SP)

550. Snow Hydrology. Provides students with a detailed understanding of the physics and hydrology of seasonal snowpacks and their influence on the hydrology of small to mesoscale catchments. (3SP)

618 (d418). Hillslope Geomorphology. Focuses on movement and storage of sediment on hillslopes and in small channel systems. Develops an understanding of processes responsible for shaping hillslopes and examines effects of land management on those processes. Prerequisites: Geog 113, Geol 111, or WS 300. (4F)

661. Stream Ecology. Structure, function, and dynamics of flowing water ecosystems. Emphasis is on the ecological functioning of natural ecosystems and the effects of watershed and channel disturbance on these processes. Prerequisites: introductory courses in general ecology or permission of instructor. (3F)

*672. Forest Biogeochemistry.** Study of inputs, cycling patterns, and outputs of major nutrients in forest ecosystems; influence of management and global environmental impacts, impact on water quality; controlling mechanisms with focus on analysis methods. Prerequisite: FR 626/527 with Mich 635 recommended. (3Sp)

682. Watershed Science Seminar. Review and discussion of current literature and developments in watershed science. (1W) ®


699. Continuing Graduate Advisement. (1-3F,W,Sp,Su) ®


799. Continuing Graduate Advisement. (1-3F,W,Sp,Su) ®

* Repeatable for credit. Check with major department for limitations on number of credits that can be counted for graduation.

* Taught 1996-97.

** Taught 1996-97.

Interdisciplinary Certificate Program in

Natural Resource and Environmental Policy

Director: Assistant Professor Joanna Endter-Wada, Department of Forest Resources
Office in Natural Resources 360, 797-2487

Program Office: Natural Resources 355, 797-2797

Affiliated Faculty: Professors Loren R. Anderson, Civil and Environmental Engineering; David S. Bowles, Civil and Environmental Engineering; Anne M. Butler, History; John R. Cragun, Management and Human Resources; Herbert H. Fullerton, Economics; E. Bruce Godfrey, Economics; Craig W. Johnson, Landscape Architecture and Environmental Planning; John E. Keith, Economics; James J. Kennedy, Forest Resources; Richard S. Krannich, Sociology, Social Work and Anthropology; Ronald L. Little, Sociology, Social Work and Anthropology; Kenneth S. Lyon, Economics; Glenn M. McEvoy, Management and Human Resources; Joan R. McFadden, Human Environments; Clyde A. Milner II, History; Jon R. Moris, Sociology, Social Work and Anthropology; Carol A. O'Connor, History; F. Ross Peterson, History; V. Philip Rasmussen, Agricultural Systems Technology and Education; David L. Rogers, Sociology, Social Work and Anthropology; Randy T. Simmons, Political Science; Donald L. Snyder, Economics; Philip R. Steensen, Business Administration; Richard E. Toth, Landscape Architecture and Environmental Planning; Frederic H. Wagner, Fisheries and Wildlife; Wynn R. Walker, Biological and Irrigation Engineering; Associate Professors Caryn Beck-Dudley, Management and Human Resources; Susan E. Dawson, Sociology, Social Work and Anthropology; R. Ryan Dupont, Civil and Environmental Engineering; Edward W. Evans, Biology; David B. Goetze, Political Science; James W. Hafner, Biology; Robert J. Lilieholm, Forest Resources; David R. Lewis, History; Gary E. Madsen, Sociology, Social Work and Anthropology; Dennis A. Nelson, Health, Physical Education and Recreation; John K. Nicholson, Landscape Architecture and Environmental Planning; G. Allen Rasmussen, Rangeland Resources; Veronica Ward, Political Science; Assistant Professors Helen R. Aspaas, Geography and Earth Resources; Dale J. Blahna, Forest Resources; Mark W. Brinson, Forest Resources; D. Layne Coppock, Rangeland Resources; Christopher Fawson, Economics; Thomas B. Hardy, Civil and Environmental Engineering; Michael R. Kuhns, Forest Resources; Michael S. Lyons, Political Science; John C. Schmidt, Geography and Watershed Science; Robert H. Schmidt, Fisheries and Wildlife, Research Assistant Professor Gregory K. Perrier, Rangeland Resources
**Program Description**

The Natural Resource and Environmental Policy Certificate Program is designed to prepare resource and environmental professionals to meet the challenges of implementing public policy changes. Many of the problems confronting natural resource and environmental managers in the future will be social, as well as technical, in nature. Public involvement in decision making, equity concerns, and conflict management are becoming critical issues. Resource professionals are increasingly challenged to design management strategies and public policies that maximize human well-being, environmental quality, and ecological integrity. The Policy Program is an interdisciplinary program to train students for careers in government, education, consulting, and conservation.

The certificate program provides students with a comprehensive educational framework for understanding complex natural resource and environmental concerns and to develop the critical thinking and analytical skills needed to address these issues. Students develop familiarity with both disciplinary and interdisciplinary concepts and principles of the social, natural, and physical science approaches to natural resource policy. Students engage in educational activities and thesis projects designed to apply this training to current policy issues. The primary objective is to prepare students to develop innovative, creative, and feasible natural resource and environmental policies and management strategies.

All eight colleges, as well as fourteen departments, at Utah State University participate in the Natural Resource and Environmental Policy Program and are represented on the Policy Program Advisory Committee.

**Certificate**

Students who complete the Policy Program receive a certificate in Natural Resource and Environmental Policy. Notification of this certificate appears on the student's transcript.

**Admission Requirements**

Admission to the Certificate Program is open only to students accepted into a Plan A master's program or a doctoral program at Utah State University who have satisfied program prerequisites. Interested students should contact their department for information regarding admission into degree programs and financial aid. Students should contact the Policy Program Director to request acceptance into the Natural Resource and Environmental Policy Graduate Certificate Program.

Prerequisites for acceptance into the Natural Resource and Environmental Policy Graduate Certificate Program are (1) acceptance in a Plan A master’s or a doctoral degree program at Utah State University; (2) undergraduate or other experience in the natural and social sciences; and/or (3) demonstrated understanding of general ecological principles, earth processes, and social systems. A standing Admissions Subcommittee of the Policy Program Advisory Committee reviews graduate student requests for admission to the program to determine whether prerequisites have been met.

To meet the natural sciences prerequisite, students must have taken an upper-division course focusing on the operation of natural systems, such as a course in ecology, biological systems, ecosystem management, or earth processes. Professional experience equivalent to such a course is also considered as having met the natural sciences prerequisite. Students without sufficient natural science backgrounds are required to take Geog 630—Global Environments, Biol/FW 386—General Ecology for Life Science Majors, FW 527—Advanced Conservation Biology, and/or an equivalent course to fulfill the prerequisites prior to certificate coursework.

To meet the social sciences prerequisite, students must have taken an upper-division course focusing on the operation of social systems, such as a course from the fields of economics, political science, sociology, or anthropology. Professional experience equivalent to such a course may also be considered as having met the social sciences prerequisite. Students without sufficient backgrounds in social sciences will be required to take Econ 255 or 554; Soc 350, 361, 401, or 462; and/or PolSci 310, 411, or 413 and/or equivalent courses to fulfill the prerequisites prior to certificate coursework.

**Graduate Committee**

The student's graduate committee must include one member affiliated with the Policy Program to advise the student on meeting the program requirements and in selecting core courses.

**Course Requirements**

The Graduate Certificate Program draws on a variety of courses to provide an integrated, interdisciplinary program. An integrative cornerstone seminar offered each year as a team-taught course, NR 643—Natural Resource and Environmental Policy Cornerstone Seminar, is normally taken in the student's first year. Students are expected to take at least four of the core policy courses listed below to gain perspective on different disciplinary approaches to natural resource policy. Another program activity is the Policy Program Seminar Series, NR 644, which features invited speakers and must be attended by students for credit. In another required seminar, NR 645, graduating students make a presentation on the policy dimensions of their thesis or dissertation.

The following are the Natural Resource and Environmental Policy Certificate core courses: ASTE 620, A Systems Approach for Analyzing Agricultural Issues; CEE 661, Environmental Management and Regulation; Econ 556, Natural Resource Economics; Econ 656, Resource Economics; FR 510, Human Dimensions of Natural Resource Management; FR 555, Environmental and Natural Resources Law and Policy; FW 601, Advanced Fisheries and Wildlife Program Administration; FW 635, Wildlife Damage Management Policy; Geog 655, Environment, Resources, and Development Policy; Hist 630, American Environmental History Seminar; LAEP 690, Environmental Impact Analysis; PolSci 618, Natural Resources and Environmental Policy; RR 520, Recreation Resource Policy; RLS 510, Conflict Management in Natural Resources; Soc 662, Sociology of Natural Resources; Soc 663, Social Impact Assessment; WS 690, Western United States Water Policy. Other courses may be included in the list of core courses by action of the Policy Program Faculty Advisory Committee.

Approved core courses may be part of a student's departmental requirements; however, only one core course taught in the student’s department may be applied toward the certificate.
Departments of Instruction

School of Accountancy
College of Business

Head: Ernst & Young Professor Clifford R. Skousen, financial, managerial, governmental, and international accounting
Office in Business 511, 797-2330

Director, Master of Accounting Program: Associate Head and Professor James W. Brackner, managerial, cost, and government contract accounting
Office in Business 518, 797-2340

Director of Research: Professor Richard L. Radliff, auditing

Professor Frank A. Condie, taxation and managerial accounting; Richard C. and Vera C. Stratford Professor David H. Luthy, financial and cost accounting; Arthur Andersen Executive Professor Jay H. Price, Jr., financial accounting; Professors Emeritus Norman S. Cannon, Larzette G. Hale; Associate Professors Richard L. Jenson, systems and financial accounting; I. Richard Johnson, financial accounting; Assistant Professors E. Vance Grange, taxation and managerial accounting; Irvin T. Nelson, managerial and cost accounting; Adjunct Assistant Professors M. K. Jeppesen, managerial accounting; Dale G. Siler, taxation; Instructors Ralph L. Peck, financial accounting; Franklin D. Shuman, financial and managerial accounting

Degree offered: Master of Accounting (MAcc)

Specializations: Standard Program, Taxation

Admission Requirements

See general admission requirements, pages 25-26. In addition, candidates are selected based on the combined consideration of their score on the Graduate Management Admissions Test (GMAT) and their grade point average from their previous 90 quarter hours. Generally, 200 times the GPA, plus the GMAT score, must total 1,150 or more. A personal interview with accountancy faculty members may be required. Professional experience and leadership are also considered. USU accounting majors may apply for admission to the graduate program after completing the junior year of the baccalaureate program. Senior courses may be taken along with graduate courses, for which prerequisites have been completed, using split registration forms.

Students with an undergraduate degree in accounting that meets the USU undergraduate accounting program requirements have completed all of the preparatory work for graduate study. Students with less than the equivalent of the undergraduate program are expected to make up the deficiencies. The director of the Master of Accounting program will assist in necessary program scheduling. Students are encouraged to satisfy undergraduate deficiencies by taking equivalent graduate business administration, management and human resources, and economics core courses when possible.

Graduate students are expected to maintain an overall GPA of 3.0 to remain in the program.

Complete information relative to the details of the program and course scheduling is available from the School of Accountancy.

Course Requirements

Students must complete 45 credits beyond the preparatory coursework or equivalent, of which at least 30 credits must be taken in courses numbered 600 or above.

Students are expected to complete 27 credits, as listed below in the area of concentration, and 18 credits of approved electives, at least 11 of which must be nonaccounting. In addition, students who have a baccalaureate degree in accounting from USU must complete at least 162 quarter credits outside the accounting discipline in their combined baccalaureate and MAcc programs. (If Acctg 521, Advanced Accounting I, or Acctg 541, Income Taxation II, have not been previously taken, they must be elected.)

Standard Specialization. The following courses are required of students selecting the standard specialization: BIS 615; Acctg 621, 635, 650, 651, 661, and accounting elective.

Taxation Specialization. The following courses are required of students selecting the taxation specialization: BIS 615; Acctg 621, 641, 642, 643, 644, and 646.

Note: Accounting 600-level courses, except 601, 602, 605, and 610 are open only to students who are
matriculated in graduate programs and who meet course prerequisites.
A list of approved accounting electives is available from the School of Accountancy office.

Financial Assistance
Limited financial assistance is available in the form of President's Fellowships, Graduate School Fellowships, graduate assistantships, and special School of Accountancy scholarships. Applications for assistance should be made after the application for admission to the School of Graduate Studies is filed, but before April 1 of each year. Application forms are available in the School of Accountancy, and the awards are normally announced by May 15.

Professional Organizations and Activities
Graduate students are encouraged to participate in professional organizations such as the USU chapters of Beta Alpha Psi (National Honor and Professional Fraternity), and the Institute of Management Accountants. The Federation of Schools of Accountancy, the American Institute of Certified Public Accountants, the Utah Association of Certified Public Accountants, and other professional organizations sponsor professional activities for accounting graduate students.

Accounting Courses
505. Management Accounting Issues and Problems. Issues and problems in management accounting relating to accounting, finance, and management. Prerequisite: senior level accounting major or consent of instructor. (4S)

521. Advanced Accounting I. Includes accounting for government and nonbusiness organizations, an introduction to consolidated financial statements, and accounting for multinational organizations. Prerequisite: Acctg 312. (4F,W,Sp)

541. Income Taxation II. Federal income taxation of partnerships, corporations, S-corporations, estates and trusts, and gifts. Prerequisite: Acctg 341. (4F,W,Su)

601, 602. Accounting for Management Control. An introduction to accounting at the graduate level. (3F:3W)

605. Professional Accounting Cases and Problems. Cases and problems relating to professional accounting practice and theory. Prerequisites: Acctg 313, 521, 541. (4Sp,Su)

610 (d410). Government Contract Administration. Provides basic information and description of the government contracts (primarily U.S. Government Contracts). Emphasis is on the administration of and accounting for these contracts. (4)

621. Advanced Accounting II. Major emphasis on consolidated financial reporting. Includes an introduction to partnerships, estates and trusts, and bankruptcy. Prerequisite: Acctg 521. (4W, Su)

635. Advanced Managerial Accounting. Contemporary developments in managerial accounting and control. Includes a study of the controllership function. Prerequisite: Acctg 203 or 602. (4F,Sp,Su)

641. Tax Research and Procedures. Methods of researching tax problems, case studies in tax administration, civil procedures and penalties, professional responsibilities and tax ethics for the tax practitioner. Prerequisites: Acctg 341 and 541. (4F)

642. Taxation of Corporations and Shareholders. Concepts and principles governing the taxation of corporations and shareholders; the effect of taxes on corporation formation, capital structure, distributions, liquidations, and reorganizations. Prerequisites: Acctg 341 and 541. (4F)


644. Taxation of Partnerships, Estates, and Trusts. Concepts and principles governing the taxation of partnerships and partners and estates, trusts, and beneficiaries; the uses of partnerships and trusts in tax planning. Prerequisites: Acctg 341 and 541. (4F)

645. Taxation of Property, Oil, and Gas. Recognition and character of gains and losses on sales, exchanges, and other transactions in property for tax purposes; tax basis and holding period. Oil and gas problems. Prerequisites: Acctg 341 and 541. (4)

646. Tax Topics. Topics of current interest to beginning tax professionals. Prerequisites: Acctg 341 and 541. (4Sp)

650. Accounting Information Systems II. Contemporary issues in accounting information systems, including alternative processing methods, system evaluation and selection, and computer-based audit and security. Prerequisite: Acctg 450. (4F)

651. Auditing II. Application of GAAS to accounting systems. Some study of auditing theory and current issues, and an introduction to statistical auditing. Prerequisite: Acctg 451. (4Sp)

661. Accounting Theory and Research. Analytical approach to understanding the financial reporting environment. Integration of accounting theory and practical research methodology in the resolution of financial reporting problems. Prerequisites: Acctg 313. (4W,Su)

665 (d365). Accounting Topics and Issues. Selected contemporary accounting topics and issues, including the study of accounting for specialized industries. (1-4) ©

679. Internship in Accounting. Experience in accounting functions within industry and government as well as public accounting firms. (1-7F,W,Sp,Su)

690. Independent Reading and Research. Independent work in accounting areas: theory, cost, auditing, taxation, and other areas with accounting faculty approval. (1-6F,W,Sp,Su) ©

696. Professional Paper. A paper of professional quality prepared by the student. Designed to demonstrate the ability to complete a major business related project and to effectively present the results. (1-4F,W,Sp,Su)

699. Continuing Graduate Advisement. (1-3) ©

© Repeatable for credit. Check with major department for limitations on number of credits that can be counted for graduation.

1Parenthetical numbers preceded by (d) indicate a dual listing.
Department of

Agricultural Systems Technology and Education

College of Agriculture

Head: Professor V. Philip Rasmussen, sustainable agricultural systems and soil conservation
Office in Agricultural Systems Technology and Education 101, 797-2230

Assistant Head: Assistant Professor Bruce E. Miller, agricultural systems and mechanization

Professors Robert L. Gilliland, Vice President of Extension; Gilbert A. Long, agricultural education; Weldon S. Sleight, Associate Dean of Agriculture; Associate Professors Stephen E. Poe, agricultural education/extension specialist, agricultural engineering; Gary S. Stratadine, agricultural education/extension; Assistant Professors Kathryn Farrell-Poe, agricultural and environmental engineering/extension specialist; Richard M. Joerger, agricultural education/applied technology education

Degrees offered: Master of Science (MS) and Master of Arts (MA) in Agricultural Systems Technology

Specializations: Agricultural Extension Education, Agricultural Mechanization, International Agricultural Extension, Secondary and Postsecondary Agricultural Education

Admission Requirements

See general admission requirements, pages 25-26. Applications will be considered throughout the year. However, students who wish to be considered for financial aid must submit application by February 28 for the coming academic year. No application will be considered until all required information arrives in the office of the School of Graduate Studies.

Course Requirements

Master of Science

The MS program requires the completion of a minimum of 45 credits beyond the bachelor's degree that are approved by a supervisory committee. However, to optimize a student's academic experiences, 54 credits are recommended. A 15- to 21-credit core curriculum is required and includes courses in research/statistics and completion of either a Plan A thesis for 9 credits or a Plan B report for 3 credits. Students are also expected to select and complete an area of specialization. A minimum of five quarters is expected to complete all requirements.

Four specializations are available for the MS in Agricultural Education.

The Agricultural Extension Education specialization provides a program for individuals interested in cooperative extension work. The curriculum for this program includes coursework related to managing people; planning, implementing, and evaluating programs to promote technology transfer (adult education); understanding research techniques relevant to agricultural education; and the managing of fiscal affairs. Required courses include: ASTE 612 (or 610), 614, and 651. Electives are selected from each of the following departments: Agricultural Systems Technology and Education—ASTE 600, 610, 614, 626, 655, 660; Animal, Dairy and Veterinary Sciences—ADV 608, 609, 612, 613, 619; Economics—Econ 502, 503; Entomology—Ent 530, 532, 641; Plant Science and Rangeland Resources—PlSci 555, 565, RLR 586, 600; Technology Transfer—Ins T 635, 643, 644, Soc 670.

The Agricultural Mechanization specialization allows for theoretical and applied study in the mechanical systems used in agricultural production, processing, and distribution. The curriculum for this program emphasizes coursework related to managing people; planning, implementing, and assessing systems used in the production and processing of agricultural products or services; and understanding research techniques used in agricultural systems technology. Required courses include: ASTE 600, 613, 616, 626, 655, 660, 690. The remainder of the program is designed to be interdisciplinary, depending on student needs.

The International Agricultural Extension specialization was developed to prepare agriculturally educated people to perform administrative and supervisory roles in less-developed countries. The curriculum for this program includes coursework related to managing people; planning, implementing, and evaluating programs to promote technology transfer; and managing fiscal affairs. Required courses include: ASTE 610 (or 612), 614, 651, 660; Econ 580; Comm 610; and Soc 670. Electives are selected from each of the following departments: Agricultural Systems Technology and Education; Animal, Dairy and Veterinary Sciences; Economics; Biology; Plants, Soils, and Biometeorology; and Instructional Technology.

The Secondary and Postsecondary Agricultural Education specialization provides a coordinated program of graduate study for agricultural science and technology teachers in public and higher education. The curriculum for this program includes coursework related to managing people; planning, implementing, and evaluating programs to promote technology transfer (adult education); understanding research techniques relevant to agricultural education; and managing fiscal affairs. Required courses include (1) ASTE 607, 624, 625, 660; and (2) 14-17 credits, one course from each of the following ar-
Research

The Utah Agricultural Experiment Station (an arm of the College of Agriculture) supports graduate work in several areas of Agricultural Systems Technology and Education. Other state and federal agencies also support research in agricultural systems.

Financial Assistance

Both departmental and formal grant support are available to graduate students and are awarded on a competitive basis. Students requesting financial support should apply to the department.

Research assistantships are available through faculty members who have ongoing projects with the Utah Agricultural Experiment Station or who hold special research grants from the University, private companies, or state/federal agencies. Acceptance to pursue graduate study does not guarantee the student financial assistance.

Requirement Changes

Graduation requirements described in this catalog are subject to change. Students should check with their departments concerning possible changes.

Agricultural Systems Technology and Education Courses

600. Methods of Equipment Testing, Diagnosis, and Repair. Involves the supervision and demonstration of methods and procedures for testing, troubleshooting, and diagnosis of tractors, power units, and all types of agricultural equipment. (3Sp)


603. Secondary Agricultural Education Curriculum Development (Entomology). Program and curriculum development in public secondary schools for vocational agriculture—entomology. (1-3Su)

604. Secondary Agricultural Education Curriculum Development (Range Science). Program and curriculum development in public secondary schools for vocational agriculture—range science. (1-3Su)


607. Program and Curriculum Development in Vocational Education. Program planning for locally applied curriculum designed to meet student interests and community needs for vocational teachers. (1-3F, W, Sp, Su)

610. Supervision in Extension. Study and analysis of selected principles and theories of supervision as applied to the Cooperative Extension Service or similar rural development organizations. (3W)

611. (d511). Vocational Technical Education Program Planning and Evaluation. Program planning and evaluation strategies are studied. Local manpower surveys and evaluation questionnaires are designed. Job analysis as a basis for curriculum planning. (4Sp)

612. Administration of Extension. In-depth study of selected principles and theories of administration and their application to the administration of rural development/agricultural extension operations. (3Sp)

613. Electrical and Hydraulic Component Testing, Diagnosis, and Repair. Involves the supervision and demonstration of procedures for testing, diagnosis, and repair of all types of electrical and hydraulic components on modern agricultural equipment. (3W)

614. Extension Program Planning and Evaluation. Program planning and evaluation principles and the application of program accountability to extension programs. (4Sp)

618 (d516). Applications of Agricultural Controls. Theory and application of fluids under controlled pressure in mobile systems. Fundamentals and operating principles of instruments for standard measurement, electronic instrumentation, and control. (4F)

620 (d520). A Systems Approach for Analyzing Agricultural Issues. Case studies of current controversial agricultural systems. National and global ramifications are explored. (3F)

624. Advanced Methods of Teaching Agriculture. Advanced methods of teaching at the secondary and postsecondary level as applied to the changing technology in agriculture. (3F)

625. Special Problems in Agricultural Education. A consideration of needs and special types of service in FFA, young farmers, and adult programs. (1-3F, W, Sp, Su)

626 (d526). Impacts of Agricultural Practices on Water Quality. Relationship between agricultural practices and water quality. Controlling agricultural nonpoint source pollution will also be covered. (3F)

630 (d530). Foundations of Adult Education Programs. Historical and philosophical foundations of adult and continuing education programs. Emphasizes measurable factors in administration, curriculum and program development, conducting and evaluating adult programs. (3F)

651 (d551). Principles and Practices of Extension Education. In-depth inquiry into the history, philosophy, and organizational structure of the Cooperative Extension Service programming philosophy and methodology, and teaching techniques. (3F)

655 (d555). Agricultural Water Supply. Water requirements, supplies, and treatment for domestic and livestock production systems. On-site domestic sewage disposal systems. Livestock waste properties, collection, transport, storage, and treatment. (3F)

660. Analysis of Machinery Management and Decision Making Processes. Involves the record keeping and analysis procedures for profitable decision making and machinery management related to modern production agriculture. (3Sp)

670. Introduction to Research Methodology in Ag Education. Introduction to the major research techniques used in the field of ag education. Involves research design and methods of data generation. (1-3Sp)

675. Agricultural Safety and Health: Issues and Decisions. Review of agricultural safety and health issues in western society. Public and private concerns are addressed through problem definition, resolution, and evaluation. Includes lectures, laboratories, and field studies in agricultural environments. (3Sp)

690. Agricultural Machinery Technology Research and Application. Familiarization with American Society of Agricultural Engineers' papers, textbooks,periodicals, dealers' service, training manuals, theory of design, and operation of agricultural equipment. (3Sp, Su)

691. Special Problems for Vocational Teachers. For teachers who participate in annual summer conference workshops. (1-3F, W, Sp, Su)

697. Research and Thesis. (1-3F, W, Sp, Su)

699. Continuing Graduate Advisement. (1-3F, W, Sp, Su)

(1) Repeatable for credit. Check with major department for limitations on number of credits that can be counted for graduation.

Parenthetical numbers preceded by d indicate a dual listing; parenthetical numbers preceded by f are the former course numbers.
Department of

Animal, Dairy and Veterinary Sciences

College of Agriculture

Head: Professor Robert C. Lamb, dairy genetics, management

Assistant Head: Professor Mark C. Healey, immunoparasitology

Graduate Program Coordinator: Research Assistant Professor Jeffrey L. Walters, dairy breeding, statistics

Office in Agricultural Science 228, 797-2145

Professors Stanley D. Allen, veterinary diagnostics, antimicrobial testing; Clive W. Arave, dairy management, animal behavior; Clell V. Bagley, veterinary medicine; Thomas D. Bunch, cytogenetics; Roger A. Coulombe, Jr., veterinary toxicology, molecular biology; Lyle G. McNeal, sheep production, wool science; R. Dean Plowman, dairy genetics, management; Robert W. Sidwell, virology; Ross A. Smart, veterinary diagnostic pathology; Norris J. Stenquist, livestock production, nutrition; Wallace R. Taylor, dairy breeding, dairy herd improvement; Professors Emeriti James A. Bennett, John E. Butcher, Jay W. Call, C. Elmer Clark, Grant M. Esplin, Warren C. Foote, Doyle J. Matthews, James LeGrande Shupe, Don W. Thomas; Adjunct Professors E. Marloose Goble, orthopedic biomechanics; Lynn F. James, animal physiology; Nicholas C. Leone, veterinary science, comparative clinical medicine; Adjunct Research Professor Michael R. Marshall, veterinary science; Associate Professors W. Craig Burrell, livestock management; Noelle E. Cockett, molecular genetics; Howard M. Deer, pesticides, toxicology; Haven B. Hendricks, swine production; Nyle J. Matthews, livestock management; Kenneth C. Olson, range livestock nutrition; Larry M. Slade, equine nutrition, management; Kenneth L. White, reproductive physiology; Randall D. Wedemeier, beef cattle nutrition; Associate Professors Emeriti Melvin J. Anderson, Donald C. Dobson, Darrell H. Matthews, Charles H. Michelsen; Adjunct Associate Professor Kip E. Panter, animal science/toxicology; Research Associate Professors Ronald L. Boman, dairy nutrition, management; John D. Morrey, virology; Donald F. Smeeg, virology; Adjunct Research Associate Professors Dale R. Gardner, analytical chemistry; John D. Olsen, veterinary physiology; Assistant Professor G. Reed Holyoak, animal diseases; Adjunct Assistant Professors David H. Clark, ruminant nutrition; David D. Frame, animal diseases; John T. Lohr, microbiology; Kathleen R. Rasmussen, immunoparasitology; Bryan L. Stegelmeyer, pathology; Research Assistant Professors Dale L. Barnard, virology; Robert E. Buckner, turkey nutrition; John H. Huffman, virology; M. Keven Jackson, veterinary pathology; virology; Shiquan Wang, reproductive physiology, molecular biology; Shiguang Yang, immunoparasitology; Research Assistant Professor Emeritus Robert E. Warnick; Adjunct Research Assistant Professors Frank L. Barnes, reproductive physiology; Philippe Collas, biology, reproductive physiology; Gary D. Snowder, animal genetics; Instructors Parli Galloway, animal science; Jonathan W. Merriam, dairy herdman; Milan Shipka, dairy science; Lecturer J'Wayne McArthur, western horsemanship

Degrees offered: Master of Science (MS) in Animal Science, Dairy Science, and Bioveterinary Science; Doctor of Philosophy (PhD) in Animal Science

Specializations: Animal or Dairy Science only—Animal Nutrition, Breeding and Genetics, Molecular Biology, Reproductive Biology; MS only—Animal or Dairy Management

Admission Requirements

In addition to the general admission requirements (see pages 25-26) applicants should have satisfactory (3.0 GPA or better) grades in completion of previous degree programs. Verbal, quantitative, and analytical scores at or above the 40th percentile are required.

Applicants for graduate programs in animal or dairy science should have a BS degree in animal or dairy science or have equivalent background in the majority of the agricultural, biological, and physical science courses required for the department's undergraduate majors. Applicants with deficiencies in these areas may be admitted to the graduate program subject to the completion of remedial coursework specified by the department.

Applicants to the bioveterinary science graduate program should have a degree in bioveterinary science, biology, microbiology, chemistry, or one of the animal sciences. Preveterinary students oriented towards graduate research studies are strongly encouraged to apply.

Animal and Dairy Science Degree Programs

Students pursuing MS degree programs are admitted to one of five specializations in Animal Science or Dairy Science. Students pursuing PhD degree programs are admitted to one of four specializations in Animal Science.

Animal Nutrition. This specialization involves studies in biochemistry, principles of nutrition, animal management, nutritional physiology, and animal feedstuffs. Cooperation with producers, feed industry groups, other departments of the University, and USDA collaborators, along with research funding from private industry, strengthens the graduate program in this area. Career opportunities exist in extension, university and private research, the commercial animal feedstuffs industry, private consulting firms, and international programs.

Course requirements: Students in the MS program are required to complete the following courses: ADVS 601,
Breeding and Genetics. This specialization involves studies in cytogenetics, molecular genetics, quantitative genetics, statistics, and animal management. Cooperation with the Biotechnology Center, USDA, other departments of the University, collaborators at other research institutions, livestock producers, and commercial biotechnology companies broadens the resources of this graduate program. Career opportunities exist in extension, university and private research, commercial animal breeding and genetic engineering enterprises, and international programs.

Course requirements: Students in the MS program are required to complete the following courses: ADVS 601, 630, 680, 682; Biol 519; Stat 502. Students in the PhD program are required to complete the following courses: ADVS 680; Chem 670, 672; and one Stat course in addition to Stat 502.

Students in this specialization may choose elective courses to fulfill the required credits for their degree from the following courses: ADVS 608, 609, 612, 613, 619, 620; Biol 505, 517, 521, 525; PSci 570, 660; Stat 503, 520.

Molecular Biology. This specialization involves studies in molecular genetics, biochemistry of nucleic acids, advanced cell biology, quantitative genetics, and reproductive physiology. This is part of the Interdepartmental Program in Molecular Biology. Students who choose this specialization must meet both the ADVS and the Molecular Biology requirements. Cooperation with other departments, particularly the Department of Biology and the Department of Chemistry and Biochemistry; with the Biotechnology Center and other research centers of the University; and with USDA collaborators allows for a strong graduate program in this area. Career opportunities exist in extension; university and private research; the pharmaceutical, embryo transfer, and artificial insemination industries; private consultation; and international programs.

Course requirements: Students in the MS program are required to complete the following courses: ADVS 601, 620, 680; Phys 503; Stat 502, 503. Students in the PhD program are required to complete the following courses: ADVS 680; Biol 521; Chem 670, 671; Microb 503; and Stat 502, 503 or equivalent. MS students are also required to take 13 additional credits and PhD students 22 additional credits in related areas as advised by their supervisory committees.

Animal or Dairy Management (MS only). This specialization involves studies in the applications of the principles of genetics, reproductive biology, and nutrition to animal or dairy management at an advanced level. Appropriate emphasis is also placed on statistics, economics and business administration, and range management. The management specialization offers the option of degree programs with or without thesis (Plan A or Plan B). Graduates in management from a program including thesis (Plan A) may pursue advanced studies in more specialized fields. The MS in management without a thesis (Plan B) is considered a terminal degree. Career opportunities include extension, private consultation firms, farm and ranch management, sales and service to agricultural producers, agricultural finance, and international programs.

Course requirements: Students choosing the option with thesis (Plan A) are required to take the following courses: ADVS 601, 620, 630, 653 or 654, 680; Stat 502, 503, plus one of the following courses (if comparable course not previously completed at undergraduate level): ADVS 608, 609, 612, 613, 619. Students choosing the option without thesis (Plan B) are required to take the following courses: ADVS 601, 620, 630, 653 or 654, 680; Econ 500, 501, 503, 533; plus one of the following courses (if comparable course not previously completed at undergraduate level): ADVS 608, 609, 612, 613, 619.

Students following the thesis option (Plan A) are required to take at least 6 additional credits in related areas as advised by their supervisory committees. Students choosing the degree option without thesis (Plan B) may select additional courses from the following: Acctg 601, 692; ADVS 586, 655, 659; BA 444, 445, 635; Econ 524; MHR 600; RLR 563, 565, 568, 600.

Bioveterinary Science Degree Program (MS Only)

This degree program involves studies in biochemistry, statistics, pathology, toxicology, virology, parasitology, pharmacology, microbiology, and laboratory animal management. Advanced techniques in laboratory procedure and animal health research are emphasized. Cooperation with other departments and research centers of the University and with federal collaborators and agencies allows for a strong graduate program in bioveterinary science. Career opportunities in this area exist in research, management and submanagement positions in public and private health research and testing organizations, and commercial industries in the health field. Graduates from this program may seek admission to advanced degree programs in the biological sciences or veterinary medicine.
**Course requirements:** Students in the MS program in bioveterinary science are required to complete the following courses: ADVS 601, 669, 670, 671, 680; Stat 502.

Students may also take courses from among the following as advised by their supervisory committees: ADVS 516, 524, 526, 620, 635, 649, 650, 651, 660, 671, 682; Biol 505, 540; Chem 670, 671; Microb 502, 503, 570, 571, 603; Physi 503; Zool 555.

**Research**

The ADVS department conducts a broad range of basic and applied research in the areas of animal reproduction, animal nutrition, livestock and dairy management, animal health, virology, parasitology, toxicology, animal behavior, cytogenetics, and molecular genetics. Department facilities include over 30 research laboratories on campus and at local and regional animal research facilities. There are research herds and flocks of beef and dairy cattle, sheep, and swine housed close to the University. There are additional research units housing beef cattle, sheep, and turkeys located throughout the state. Research in the department is funded by a multimillion dollar budget derived from support by the Utah Agricultural Experiment Station and by substantial outside contracts and grants. Cooperation with other departments and research centers of the University and with federal collaborators enhances the ADVS research and graduate programs. Significant in this regard are the University Biotechnology Center, the Utah State Animal Disease Diagnostic Laboratories, the Laboratory Animal Research Center, the Center for Environmental Toxicology, the Center for the Genetic Improvement of Livestock, and the on-campus USDA Poisonous Plant Laboratory.

**Financial Assistance**

Both departmental and research grant support are available to matriculated graduate students on a competitive basis. The department funds a number of graduate assistantships, which are available on a competitive basis to matriculated graduate students who are U.S. citizens, nationals, or residents. Students interested in departmental assistantships may request an application form from the department. Applications for assistantships for the following academic year must be submitted by April 1.

Acceptance to graduate study in the ADVS Department does not constitute a guarantee of financial assistance.

**ADVS Courses**

**516. Methods in Biotechnology: Cell Culture.** Laboratory-intensive course in basic and applied methods of culturing cells (mammalian, insect, plant) and methods of fusing and transforming cells. Prerequisites: Biol 125 or ADVS 316 or equivalent, or permission of instructor. (SW)

**524. Methods in Biotechnology: Protein Purification Techniques.** Laboratory-oriented course designed to provide basic knowledge in protein purification, analysis, and its scale-up. Prerequisites: Chem 370 or ADVS 316, or permission of instructor. (SP)

**526. Methods in Biotechnology: Molecular Cloning.** Laboratory-oriented course in molecular cloning techniques such as DNA cloning, genetic probes, PCR, DNA sequencing. Prerequisites: Chem 370 or Biol 310 and Microb 301 or equivalent, ADVS 316, or permission of instructor. (SP)

**586. Poisonous Range Plants Affecting Livestock.** Poisonous plants of rangelands and their effects on grazing animals, especially livestock. Management practices to reduce or prevent poisoning. (SW)

**601. Animal Research Orientation.** Orientation to research procedures and methods in the animal sciences and introduction to the design and analysis of experiments. For beginning graduate students. (SP)

**608 (d508). Beef Cattle Management.** Managing the beef enterprise to yield optimum returns through integrating resource use and applying breeding, nutrition, reproduction, and animal health practices. Three lectures, one lab. Prerequisites: ADVS 208, 351, 421, 457; or instructor's consent. (SP)

**609 (d509). Sheep Management and Wool Technology.** Detailed study of the managerial considerations for range and farm flock operations. Examination of wool and a review of wool clip handling and merchandising. Three lectures, two labs. Prerequisites: ADVS 209, 351, 421, 457; or instructor's consent. (SP)

**612 (d512). Swine Management.** Management decisions based on nutrition, breeding, programs, herd health practices, herd records, and marketing opportunities. Three lectures, one lab. Prerequisites: ADVS 312, 351, 421, 457; or instructor's consent. (SP)

**613 (d513). Dairy Cattle Management.** Evaluating dairy herds and planning for future improvements, using management records on herd performance, individual student oral and written reports. Two lectures and one lab. Prerequisites: ADVS 213, 351, 421, 457; or instructor's consent. (SP)

**618 (d519). Horse Management.** Management decisions in horse enterprises with emphasis on records, nutrition, breeding, health, facilities, and merchandising. Three lectures, one lab. Prerequisites: ADVS 218, 351, 421, 457; agricultural economics; or instructor's consent. (SP)

**620. Physiology of Reproduction.** A study of the processes of reproduction in mammals, including mechanisms of control. Three lectures, one lab. Prerequisites: Phys 501, 502, and organic chemistry. (SP)

**630. Animal Breeding Theory.** Basic theoretics of populations as applied to breeding and improvement of domestic animals with emphasis on effects of directed selection and effective breeding plan design. Prerequisites: ADVS 456, genetics. (SP)

**651. Techniques in Nutrition Research.** Review and practice in evaluating feeding and feeds. Two labs. Prerequisites: ADVS 350, 351, (SP)

**652. Nutritional Management of Ruminants.** Nutritional management, problem solving, and feeding strategies as they influence animal performance. One lecture, two labs. Prerequisites: ADVS 608, 609; or ADVS 613, (SP)

**654. Nutritional Management of Nonruminants.** Nutritional management, problem solving, and feeding strategies as they influence animal performance. Two lectures, two labs. Prerequisites: ADVS 612 or 619, (SP)

**655. Rumen Physiology and Metabolism.** Principles in rumen physiology and metabolism. Demonstrations of various techniques in rumen microbiology and nutrient metabolism. Prerequisites: ADVS 350, 351. (SP)

**659 (d559). Wool Science.** Biology of fiber growth: Histology, fiber arrangement, morphology, and fleece genetics. Environmental and physiological factors affecting wool growth. Prerequisite: Biol 129. (SP)

**660. Principles of Toxicology.** Mechanisms of action and effects of toxicants on living organisms. Four lectures, one lab. Prerequisite: ADVS 615, (SP)

**662. Molecular and Biochemical Toxicology.** Molecular and biochemical mechanisms involved in toxic reactions. Prerequisite: ADVS 600 or instructor's consent. (SP)
669 (d569). Animal Histology. Introduction to the microscopic anatomy of normal, domestic animal cells, tissues, and organs. Three two-hour lectures/laboratories each week. Prerequisite: ADVS 120 or permission of instructor. (3F)

670 (d570). General Pathobiology. Principles of structural and functional mechanism of abnormal reactive processes in animals. Three lectures, two labs. Prerequisite: ADVS 669. (5W)

671 (d571). Special Pathobiology. Correlates abnormality with causes; disease processes studied by systems, organs, and cells. Three lectures, two labs. Prerequisite: ADVS 670. (5Sp)


681. Seminar in Toxicology. (1W,Sp)®

*682 (d582). Animal Cytogenetics and Methods in Cell Culture and Chromosome Banding Techniques. Structure and properties of chromosomes, chromosome behavior during cell division, chromosomal influence on the phenotype, and factors that cause chromosomal change. Emphasis on clinical problems affecting man and livestock. Two lectures, one lab. (3Sp)

**685 (d585). Range Livestock Nutrition and Management. Principles of livestock nutrition and production applied to the grazing environment and the relationships of livestock and range management for optimizing values from both. For nonmajors. Prerequisites: RLR 300, ADVS 351. (3W)

752 (655). Animal Energetics and Nutrient Metabolism. Bioenergetics and metabolism of nutrients as they apply to animal production. Three lectures. Prerequisites: ADVS 655, Chem 670, 671. (3W)

756 (656). Mineral Metabolism. Principal role of minerals in nutrient metabolism as it applies to animal nutrition. Prerequisite: ADVS 655. (3Sp)

757 (657). Vitamins in Nutrient Metabolism. Principal role of vitamins (fat and water soluble) in nutrient metabolism as it applies to animal nutrition. Prerequisite: ADVS 655. (3Sp)


799. Continuing Graduate Advisement. (1-12F,W,Sp,Su)®

*Taught 1995-96.
**Taught 1996-97.
® Repeatable for credit. Check with major department for limitations on number of credits that can be counted for graduation.

Parenthetical numbers preceded by d indicate a dual listing; parenthetical numbers preceded by an f are the former course numbers.

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**Department of Art**

**College of Humanities, Arts and Social Sciences**

**Head: Associate Professor Marion R. Hyde**, drawing and printmaking

Office in FAV 122, 797-3460

**Graduate Program Coordinator: Associate Professor John Neely**, ceramics

**Graduate Committee:** John Neely, chair; Craig Law, Janet Shapero, members

**Professors Jon I. Anderson**, advertising design; Glen L. Edwards, illustration; Craig Law, photography; Adrian Van Suchtelen, drawing; **Professors Emeriti R. T. Clark**, photography; Harrison T. Groutage, painting; Ray W. Hellberg, art education; Gnael Lindstrom, painting; **Associate Professor Susanne Warma**, art history; **Assistant Professors Alan Hashimoto**, graphic design; Sara J. Northerner, photography; Gregory Schulte, drawing and painting; Janet Shapero, sculpture, Thomas E. Toone, art history

**Degrees offered:** Master of Fine Arts (MFA), Master of Arts (MA)

**Specializations:** Advertising Design, Ceramics, Drawing, Graphic Design, Illustration, Painting, Photography, Printmaking, Sculpture

**Master of Arts**

Students are selected for the MA program on the basis of a portfolio demonstrating artistic individuality and a level of development beyond the need of classroom instruction.

**Admission Requirements**

In addition to meeting the requirements of the School of Graduate Studies (see pages 25-26), applicants should include the following: three letters of recommendation from qualified professionals; verbal and quantitative GRE scores at or above the 40th percentile or an MAT score at or above the 40th percentile; a portfolio of 20 slides of recent work; and a BFA or equivalent with a GPA of at least 3.0 in all art courses taken during the most recent two years of work.

Applicants not meeting minimum requirements may be allowed to correct deficiencies concurrently with graduate coursework.

**Degree Requirements**

Candidates for the MA must complete a minimum of 45 credits, to include 33 studio credits, which may be divided...
into two or three areas of study at the 500-600 level; 3 credits which may be earned in classes outside the department; 3 credits of Art 697 (Research and Thesis); and 6 credits of art history. A total of 18 credits of art history, including undergraduate credits, is required for graduation, but only 6 credits earned as a matriculated graduate student at USU may be applied toward the 45-credit MA requirement. The additional 12 credits of art history include credits earned at the undergraduate level. No more than 6 credits of 300-499-level courses are acceptable. In conjunction with the thesis exhibition, the student is required to submit a bound, illustrated, accurate analysis of the thesis project.

**Master of Fine Arts**

The MFA program is designed to allow students to mature to a level of professional competence in the making of art. Related studies augment a rigorous studio program. The prospective student must exhibit both academic excellence and a well-developed personal artistic vision.

**Admission Requirements**

The Department of Art has some special requirements for admission to the Master of Fine Arts program, over and above those requested by the School of Graduate Studies (see Admissions Procedures, pages 25-26). These requirements include a portfolio of 20 slides of recent work, and a BFA or equivalent with a GPA of at least 3.0 in all art courses taken during the most recent two years of work. The letters of reference required by the School of Graduate Studies should address the applicant's artistic as well as academic capabilities. Admission requirements for the Master of Fine Arts program are the same as for the Master of Arts program, with the additional requirement that students must have at least 18 credits of undergraduate art history to be considered for matriculated status. Completed applications for fall quarter must be received by the School of Graduate Studies by March 15.

**Degree Requirements**

Students must earn 90 credits, to include 75 credits in the major area (including Research and Thesis), 9 credits of seminars, and 6 credits of electives as specified by the supervisory committee, and must complete an MFA thesis exhibition, a supporting paper, and an oral defense.

A candidate must complete a minimum of six quarters in residency. Nine credits per quarter is considered full-time graduate enrollment; 12 credits are considered a maximum. A minimum of eight quarters is thus required to complete the 90-credit program; most students require three years.

In conjunction with the thesis exhibition, a student must submit a bound, illustrated report and an adequate selection of slides.

**Financial Assistance**

Departmental support is available to graduate students on a competitive basis. Students requesting financial support should apply to the department by March 1. Other assistance is available through the University Financial Aid Office. Students should note that applications for Federal Work Study should be mailed during the first week of February.

**Art Courses**

514. **Student Teaching at University Level.** Teaching techniques and procedures for university level. Prerequisite: approval of major professor. (1-9F,W,Sp)⑥

515. **Ceramic Studio.** Selected topics in contemporary ceramic techniques, including glaze formulation, firing, etc. Prerequisites: Art 217, 216, 317, 218. (3-9F,W,Sp,Su)⑧

521. **Advanced Life Drawing.** Drawing from the model with concern for the human figure but with greater emphasis on interpretive approaches and composition. Prerequisites: Art 333, 421. (3Sp)⑨

522. **Drawing Studio.** Advanced individual drawing projects dealing with a central theme and a specific approach. Prerequisite: approval of major professor. (1-9)⑥

526. **Art Studio.** Advanced problems in emphasis, medium, and idiom of student's choice. Student plans project and executes it through individual initiative and scheduled consultation with the instructor. Prerequisite: consent of instructor. (1-9F,W,Sp)⑥

527. **Painting Studio.** Designed to develop creative problem solving through the process of research and experimentation. Various painting ideas and painting media may be explored. Prerequisites: Art 120, 126; consent of instructor. (1-9F,W,Sp)⑥

528. **Advanced Painting.** Special problems in painting, focusing on the conceptual aspects of painting and the development of each student's individual abilities. Prerequisites: Art 226, 326, 427. (3Sp)

529. **Figure Painting.** Painting from the live model with emphasis on solving problems of the planar structure of the human form. Prerequisites: Art 326 and 421. (3F,Sp)

531. **Advertising Design Studio.** Theory of designing the complete advertising campaign. Training in producing professional advertising for employment in this field. Prerequisites: Art 231, 334. (1-9F,W,Sp)⑩

535. **Advanced Illustration.** Illustration on a professional level. Experimentation with in-class work encouraged. Most guest artist assignments given in this class. Prerequisite: Art 335. (1-9)⑥

537. **Illustration Studio.** Illustrations of a specific nature, determined by the student and instructor, are produced. Concurrent enrollment in Art 535, to work from the model, is required. Prerequisite: approval of major professor. (1-9F,W,Sp)⑥

540. **Photography Studio.** Student designs own project in conjunction with instructor, then works independently. Especially important for advanced students who have decided on a specialty area. Prerequisites: Art 240, 340 and approval of major professor. (1-9F,W,Sp)⑥

541. **Photography Illustration.** Great emphasis placed on the thinking, planning, and interpreting of an idea photographically. Applied or commercial aspects of photographs produced for advertisements and editorial use. Professional portfolio pieces produced for employment in the field. Students required to have 4x5 cameras. Prerequisites: Art 240, 340, 344, 443. (3F,W,Sp)⑥

Basic Photo Illustration. (5W)  
Advanced Photo Illustration. (5Sp)

542. **Color Printing.** Fall—Color theory and production of correctly color balanced print. Winter—Manipulative capabilities and expressive potential of color printing materials. Spring—All areas of color side production, emphasizing both straight and manipulated images. Prerequisites: Art 240, 340. (3F,W,Sp)⑥  
Basic Color Printing. (3F)  
Advanced Color Printing (3W)  
Color Positive—slides. (3Sp)

545. **Advanced Design—Corporate ID.** Trademark design with applications to stationery and business forms. Portfolio perfect. Prerequisite: Art 240. (3F)⑥

546. **Advanced Design—Editorial.** Layout and design of consecutive pages in magazines and annual reports. Portfolio perfect. Prerequisite: Art 240. (3F)⑥

547. **Advanced Design—Poster.** Layout and design of posters integrating hand-lettering, typography, illustration, and photography. Portfolio perfect. Prerequisite: Art 240. (3Sp)⑥

548. **Advanced Design—Package.** Design of commercial packages. Finished work in lettering, type, graphics, and photography for portfolio perfect pieces. Prerequisite: Art 240. (3Sp)⑥
549. Graphic Design Studio. Advanced class to prepare the design major for employment in the graphic design field. Finished portfolios of package, trademarks, and editorial design worked on. Prerequisite: Art 246. (1-9Sp)®


561. Sculpture Seminar. Issues in twentieth century sculpture. Involves research, writing, and production. Prerequisite: one 400-level sculpture course. (3Sp)

580. Art History Seminar and Special Problems. Prerequisite: consent of instructor. (1-6)®

615. Graduate Ceramic Studio. Arranged to provide time, equipment, and facilities for the graduate student to pursue directed studies. Tutorial format with group critiques. Prerequisite: graduate status. (3-9)®

620. Graduate Drawing Studio. Advanced individual drawing projects designed to aid in preparation for the thesis project. Prerequisite: graduate status. (1-9)®

625. Graduate Painting Studio. Emphasis on the individual attainment of personal conviction or direction in painting. Prerequisite: graduate status. (1-9)®

630. Graduate Advertising Design Studio. Advertising, corporate, and graphic design problems leading to an understanding of major concepts concerning commercial advertising. Prerequisite: graduate status. (1-9)®

635. Graduate Illustration Studio. (Advertising, Editorial, Fashion.) Techniques in advertising illustration that meet the needs of a client and his or her audience. Prerequisite: graduate status. (1-9)®

640. Graduate Photography Studio. Designed to cover several phases of photography with emphasis on composing what we see in an artistic manner. Also, to allow graduate students to further emphasize their thesis project area of study. Prerequisite: graduate status. (1-9)®

645. Graduate Graphic Design Studio. Graphic design problems leading to an understanding of major concepts in this area. Prerequisite: graduate status. (1-9F,W,Sp)®

652. Graduate Internship/Coop. Internship/Cooperative Education work experience in art. Designed to allow graduate students to receive more complex and professional workplace experience. (1-15F,W,Sp,Su)®

655. Graduate Printmaking Studio. Intensive individual production in advanced printmaking techniques. Prerequisite: graduate status. (1-9)®

660. Graduate Sculpture Studio. Advanced individual problems in various media and technique. Prerequisite: graduate status. (1-9)®

674. (d474). Greek and Roman Art. Origin and development of the art and architecture of Crete, Mycenae, Greece, and the Roman world. (3W)

675. (d475). Medieval Art. Development of art and architecture in the west from the end of the Roman Empire to the Gothic Period. Prerequisite: Art 278 or consent of instructor. (3)

678. (d478). Renaissance Art. Development of European art and architecture from the thirteenth to the sixteenth centuries. (3)

680. Seminar. Deals with general topic of art criticism. Primary focus on contemporary work, how it relates to current social issues, and how it is interpreted by various critics. Through both oral and written seminar presentations, analytical and verbal skills of art analysis will be emphasized. (1-9)®

681. (d481). Baroque and Rococo Art. Development of art and architecture in Europe from the sixteenth to the eighteenth centuries. (3)

682. (d482). Nineteenth Century Art. Painting and sculpture from Neoclassicism to Symbolism. Prerequisite: Art 277 or consent of instructor. (3)

683. (d483). Twentieth Century Art. History of painting, sculpture, and architecture from the post-impressionists to the present. (3W)

684. (d484). American Art. History of painting, sculpture, and architecture in America from colonial times to the present. (3F)

697. Research and Thesis. Prerequisite: candidacy status. (1-9)®

699. Continuing Graduate Advisement. (1-3)®

1Parenthetical numbers preceded by d indicate a dual listing.
2Repeatable for credit. Check with major department for limitations on number of credits that can be counted for graduation.

Department of

Biological and Irrigation Engineering

College of Engineering

Head: Professor Wynn R. Walker, surface irrigation and irrigation project management
Office in Engineering Class 216, 797-2765

Professors Conly L. Hansen, food engineering; Robert W. Hill, evapotranspiration, agricultural hydrology; Richard C. Peralta, groundwater and conjunctive water management; Linda S. Powers, biotechnology; Gaylord V. Skogerboe, surface irrigation, waterlogging, and salinity; Research Professor Santibrata Ghosh, biotechnology; Professors Emeritus George H. Hargreaves, crop water requirements; Jack Keller, sprinkle and trickle irrigation; Howard B. Peterson, water quality; Glen E. Stringham, surface irrigation; Lyman S. Willardson, drainage; Associate Professors Richard G. Allen, evapotranspiration and project analysis; Christopher M. Neale, remote sensing and geographical information systems; Edwin C. Olsen III, on-farm water management; Assistant Professors Kathryn L. Farrell-Poe, water quality; Joseph Irudayyaraj, bioprocess systems, food engineering; Gary P. Merkley, main system modeling; Stephen E. Poe, agricultural systems; Research Assistant Professor Robert B. Sinclair, biotechnology; Adjunct Assistant Professor Dani Or, surface irrigation, soil physics; Research Assistant Professor Emeritus R. Kern Stuller, irrigation structures

Degrees offered: Master of Science (MS) and Doctor of Philosophy (PhD) in Biological and Agricultural Engineering; PhD in Irrigation Engineering; MS in Irrigation Science
Specializations: Agricultural Hydrology; Bioprocessing; Biotechnology; Crop Water-Yield Analysis; Drainage; Evapotranspiration; Food Engineering; Groundwater Management and Simulation; Irrigation Conveyance and Control Structures; Irrigation Project Planning, Design, and Operation and Management; On-Farm Water Management; Remote Sensing and Geographical Information Systems; Surface, Sprinkle, and Trickle Irrigation Methods

Admission Requirements

Students applying for admission to master's programs must have verbal and quantitative scores on the GRE at or above the 40th percentile. Admission committees also consider experience, undergraduate record and curriculum, and formal recommendations. A student without an undergraduate engineering background may be required to complete selected undergraduate courses prior to enrollment in graduate courses.

All students in the MS program are initially admitted as Plan B candidates; they are not required to write a thesis based on original research. They must, however, write a report on an appropriate engineering or scientific subject. The Plan B MS is a terminal degree, and those who select Plan B typically will not be permitted to continue graduate studies for the PhD. Students who choose the Plan A degree may continue for a PhD if they qualify and if all other requirements are met.

Prerequisites for Matriculation. Students who are admitted nonmatriculated or who have been changed from matriculated to nonmatriculated status will have their records reviewed by a faculty committee when they have completed 12 credits of coursework (among which must be formal engineering courses) or at the end of their third quarter at USU. Those students who have earned a 3.0 GPA at that time and desire to be matriculated may apply to the department to have their status changed. If they meet all other academic requirements of the School of Graduate Studies and the department, they will be matriculated and admitted to the degree program. When a student is admitted as a degree candidate, the committee may allow up to 18 credits taken while on nonmatriculated status to be transferred. Nonmatriculated students may continue to study at USU but without degree candidate status. At the end of their studies, nondegree students are granted a Certificate of Completion.

Prerequisite Requirements. All students must have had formal courses in engineering hydraulics, computer programming (C, FORTRAN, BASIC, or PASCAL), hydrology, and at least one year of calculus. Students without this background can satisfy these requirements by taking CEE 343 or 350; Engr 103 or CS 241; and Math 220, 221, and 222, respectively. An additional year of calculus (Math 320, 321, 322, or equivalent) is required for MS degrees in irrigation engineering and in all PhD programs. These background courses will not be counted toward the degree credit requirements.

MS in Biological and Agricultural Engineering

Students must be BS graduates of an ABET-accredited engineering program in the U.S. or its equivalent in their home countries or must take the make-up coursework required for a BS in engineering at USU. It is assumed that the bachelor's degree mathematical training includes courses in multivariable calculus, linear analysis, and differential equations. Students who have not studied these subjects will need to do so as part of the engineering make-up coursework, and the credits will not be counted towards the degree.

Three MS options are available: research (Plan A), technical practice (Plan B), and training/extension (Plan C). All MS students are admitted initially into the technical practice option. They may subsequently transfer to one of the other two options depending upon interests and skills.

Research Option. Students wishing to gain experience in irrigation research may select the research option, particularly if they have a long-term goal of PhD study. The minimum requirements for this option are 51 credits, of which 12 may be awarded for the thesis.

Technical Practice Option. Some students wishing to study for the irrigation engineering degree may not be interested in pursuing a PhD degree or in doing the research necessary for a thesis. For such students, the technical practice option is offered. The requirements for the degree are similar to those for the research option with the exception of the thesis. The 12 thesis credits are replaced by 6 credits for a significant irrigation engineering report or design project and 6 additional credits of coursework. The minimum course requirement for the technical practice option is 51 approved graduate credits.

Training/Extension Option. Students expecting to terminate their graduate studies at the MS level and wishing to develop an emphasis in the training and/or extension fields of irrigation engineering may choose the training/extension option. The same engineering BS or equivalent requirements noted under the Plan A option apply. The minimum requirements for this degree are 51 approved graduate credits. No report or thesis is required. The degree requirements under this option can be met by taking courses.

MS in Irrigation Science

Students who do not have a formal engineering degree but who wish to study irrigation are admitted to the irrigation science program. The same three options, research, technical practice, and training/extension, are available. Irrigation science differs from irrigation engineering in the relative weight of design, synthesis, and related science courses taken for the program. Those who wish to follow the research option must have had formal courses in linear analysis, differential equations, and multivariable calculus. If they have not had such courses prior to their entrance to the MS program, they may be taken at USU.

The minimum course requirements for the irrigation science MS are 51 approved graduate credits. Of this, the department allows a maximum of 12 credits for thesis or 6 credits for the technical practice report.

Doctor of Philosophy

Two PhD programs are offered in the department:

Biological and Agricultural Engineering and Irrigation Engineering. Students who have completed an MS with a thesis in an engineering discipline are eligible to apply for admission to a PhD program in either biological...
cal and agricultural engineering or in irrigation engineering. Admission will be based on the students’ prior academic records and, if they are graduates of USU, the recommendations of their graduate committees. It is assumed that students are adequately prepared in mathematics and engineering design courses to compete at the PhD level. If such is not the case, a program of courses to make up the deficiency will be required.

In addition to any prescribed review courses and seminars, the minimum requirements for a PhD program include 90 credits of approved graduate courses beyond a master’s degree, satisfactory completion of the comprehensive examinations after completion of the formal coursework, and the writing of a dissertation based on an original research project. The degree requirements beyond a master’s degree can be met by taking courses in engineering design, synthesis, and systems; mathematics; and related science.

Three credits of teaching experience are required. The PhD candidate will be assigned to a course during the final year of study and will be responsible for five lectures in the course. The candidate will be supervised by the regularly appointed instructor and will assist him/her in homework grading, examination development and grading, and student advising.

Research

The Biological and Irrigation Engineering Department is housed in the Peterson Engineering Building. In addition to the modern classrooms and laboratories in the Engineering Building, the department controls a 110-acre research farm west of Logan and a laboratory on Logan River for studying irrigation and drainage problems in the field. The department also cooperates in irrigation and drainage research projects with Utah Agricultural Experiment Station researchers, commercial farms, and the USDA Agricultural Research Service and works with the Utah Water Research Laboratory in conducting the graduate program of the department.

In more than 80 years of irrigation engineering experience, USU has attained worldwide prestige through the successful professional records of its many graduates.

The department emphasizes a program in agricultural resource engineering addressed toward defining reasonable agricultural goals on a farm, community, regional, continental, or global basis and providing a strategy for organizing and managing water resources with other resources (physical, human, economic, biologic, and natural) that must be brought together to reach desired production and environmental goals.

The department is heavily involved in overseas research and training activities concerned with managing irrigation systems, on-farm water management, and water resource development.

Research projects in several areas of irrigation and drainage engineering are currently being conducted by the department. Hence, graduate students have the opportunity to conduct research for their degree programs and obtain financial support. Current projects include hydraulics of surface irrigation, consumptive use, return flow quantity and quality of irrigation waters and application techniques, transient flow in tile drainage systems, drain envelopes, sprinkler irrigation, trickle irrigation, crop production and water requirements, salt movement, regional groundwater modeling for optimizing sustainable yield, conveyance system modeling and control, and remote sensing.

Specific research projects in the bioprocessing option include ventilation and environmental control of livestock buildings, the contribution of rural municipalities to non-point source pollution, and agricultural waste management systems.

Land application of food processing wastes, extrusion of dairy-based foods, multi-stage anaerobic digestion of biological materials, functional properties of foods, and biological detoxification of metals are some of the topics researched in food engineering.

Financial Assistance

The large departmental research programs make it possible to offer graduate students financial support in the form of assistantships and traineeships. The financial support is mainly available to U.S. citizens with a small number of assistantships for others. The traineeships and assistantships are attached to research projects on the Logan campus and overseas. Traineeships carry tuition waivers and additional financial support.

Career Opportunities

Development of irrigation systems is one of man’s oldest engineering endeavors. Irrigation makes arid land productive and provides both flexibility in cropping patterns and crop insurance in humid areas. Agricultural and irrigation engineering will be a major factor in solving world food problems. In water resource management, irrigation is a major consumptive user of water and has a significant influence on the quality change in the waters of streams. With world food problems and water pollution in the spotlight, superimposed on a mounting demand for water by all users (irrigation, power, industry, municipal, culinary, navigation, recreation, fish and wildlife), the challenge facing the irrigation engineer has never been greater and the opportunities and future have never been brighter.

The close association with departments in the Colleges of Engineering; Agriculture; Business; Natural Resources; Science; and Humanities, Arts and Social Sciences strengthens the departmental program and permits a broad multidisciplinary approach for those wishing special emphasis in related aspects of the science.

Biological and Irrigation Engineering Courses

516. Methods in Biotechnology: Cell Culture. Laboratory-intensive course in basic and applied methods of culturing cells (mammalian, insect, plant) and methods of fusing and transforming cells. Prerequisites: Biol 125 or ADVS 316 or equivalent, or permission of instructor. (3)

524. Methods in Biotechnology: Protein Purification Techniques. Laboratory-oriented course designed to provide basic knowledge in protein purification, analysis, and its scale-up. Prerequisites: Chem 370 or ADVS 316, or permission of instructor. (3)

528. Methods in Biotechnology: Molecular Cloning. Laboratory-ori-
ent course in molecular cloning techniques such as DNA cloning, genetic probes, PCR, DNA sequencing. Prerequisites: Chem 370 or Biol 319 and Mich 301 or equivalent, ADVS 316, or permission of instructor. (3P)

580. Bioprocesses in Engineered and Environmental Systems. Applications of microbial metabolism, physiology, and ecology to degradation of waste materials in engineered systems and the environment. Prerequisites: Mich 111 and 112 or Biol 125. (4P)

581. Biochemical Engineering. Fundamentals of bioreactor design and biocongeering. Emphasis is placed on microbial systems for pollution control. Prerequisites: Mich 111 and 112 or Biol 125, and BIE/CEE 397. (3W)

582. Biomass Processing. Introduction to the use of renewable resources for energy production and water management. Prerequisites: Mich 111 and 112 or Biol 125, BIE/CEE 397. (3Sp)

583. Land Treatment of Wastes. Engineering management of the upper part of the vadose zone for treatment and ultimate disposal of nonhazardous wastes, including industrial, agricultural, and domestic wastes. Prerequisites: CEE 364 and 543. (3W)

584. Agricultural Waste Management Systems. Evaluation and design of engineering treatment systems for the management of agricultural wastes, utilization of aerobic and anaerobic systems, ponds and land application facilities for agricultural waste management and control. Prerequisites: CEE 350, 351, and BIE/CEE 367. (3Sp)

603 (d543). Principles of Irrigation Engineering. For engineering students. Soil-water-plant relationships; water requirements; efficiency of water use; flow of water in soils; effects of irrigation on water quality. Prerequisites: Engr 103 or CS 241; CEE 380 concurrent. (4W)

605 (d545). Drainage Engineering for Agricultural, Urban, and Wetland Environments. Introduction to principles and practices of drainage engineering investigation and design of open drains and wells. Prerequisite: CEE 560. Three lectures, one lab. (4Sp)


607 (d547). Sprinkle and Tricklee Irrigation. Sprinkle and trickle irrigation system demand, system selection and configuration, emitter and sprinkler characteristics and sizing, uniformity and efficiency, pipe network layout and sizing, and system operation, management, and maintenance. Prerequisites: BIE 603/543, CEE 350 or 351. (5W)

608 (d548). Surface Irrigation Design. Design and evaluation of surface irrigation systems. Field measurements for evaluating and improving uniformity and efficiency. Simulation of surface systems. Land leveling computation and equipment. Prerequisite: BIE 603/543. (4Sp)

610 (d550). Irrigation System Analysis. Field lab with formal reports covering water measurement; soil-water management, land leveling, and evaluation of border, furrow, sprinkle, and trickle systems. One recitation, one double lab. Prerequisites: BIE 603/543, 607/547, 908/548 or concurrent registration. (3Sp)


625 (d525). Principles of Remote Sensing and Applications in Agriculture and Hydrology. Techniques for field ground-based measurements of reflected and emitted radiation as well as ancillary data collection to support airborne and satellite remote sensing studies in agriculture and hydrology. (4Sp)

631. Field Irrigation Management. Advanced topics in estimating crop water requirements and irrigation scheduling; crop yield models, research data analysis; effect of irrigation system design and management on crop production economics. Prerequisites: BIE 603/543, competence in FORTRAN. (3F)


680. Seminar. Offered for one credit in the fall and two credits in the winter. (1-2F, W)®

693. Special Problems in Agricultural Engineering. Independent study of problems in agricultural engineering. (1-5F, W, Sp, Su)®

696. Supervised Teaching in Irrigation. Directed graduate teaching experience for PhD students in irrigation engineering or irrigation science. Department head’s approval required for registration. (2-3P, W, Sp)


699. Continuing Graduate Advisement. (1-12F, W, Sp, Su)®


**736. Optimal Groundwater and Conjunctive Water Management II. Development and application of systems analysis and modeling techniques for managing aquifer and stream-aquifer systems. Volumetric, economic, and environmental management goals or constraints are considered. Prerequisite: BIE 735. (3Sp)

745. Drainage Investigation and Design. Comprehensive engineering of drainage systems. Investigation, design, specifications, contracts, cost estimation, outfalls, main drains, on-farm systems. Relation of drainage to total water and land use. Prerequisite: approval of instructor. (3W)

**760. Irrigation System Operations. Water resources planning, operation, and management in large-scale irrigation and drainage systems. Application of computer software to irrigation systems analysis. Prerequisite: PhD standing or approval of instructor. (4Sp)

780. Seminar. Offered for one credit in the fall and two credits in the winter. (1-2F, W)®


799. Continuing Graduate Advisement. (1-12F, W, Sp, Su)®

*Taught 1995-96.
**Taught 1996-97.
© Repeatable for credit. Check with major department for limitations on number of credits that can be counted for graduation.

1Parenthetical numbers preceded by d indicate a dual listing.
Department of Biology
College of Science

Head: Professor Edmund D. Brodie, Jr., evolution and behavior
Office in Biology-Natural Resources 117, 797-0068

Associate Head: Associate Professor David B. Brown, environmental health

Director of Graduate Studies: Professor William A. Brindley, insecticide toxicology

Professors
Anne J. Anderson, microbes in soil and in association with plants and pollutants; LeGrande C. Ellis, endocrinology of male reproduction; James A. Gessaman, vertebrate physiological ecology; Mark C. Healey, parasitology; Ting H. Hsiao, insect physiology and genetics; Joseph K.K. Li, virology; James A. MacMahon, community ecology; Keith A. Mott, plant physiology; Ivan G. Palmblad, evolutionary ecology; Jon Y. Takekoto, microbiology and molecular biology; Sherman V. Thomson, plant pathology; Reed P. Warren, immunology; Nabil N. Youssef, developmental biology.

Professors Emeritus
Thomas L. Bahler, physiology, human anatomy; Donald W. Davis, agricultural pest management; Keith L. Dixon, zoology and ornithology; B. Austin Haas, entomology, pest management; Gene W. Miller, plant biochemistry and physiology; Frederick J. Post, aquatic microbiology, microbial ecology; Reed S. Roberts, entomology; Raymond T. Sanders, cell biology, physiology; Richard J. Shaw, plant taxonomy; John R. Simmons, biochemical genetics; John J. Skujins, soil biochemistry; Hugh P. Stanley, electron microscopy; Associate Professors Diane G. Alston, integrated pest management; Mary E. Borkworth, plant systematics; Edward W. Evans, entomology, pest management, and extension; James W. Haefner, systems analysis; Wilford J. Hanson, systematic entomology, taxonomy; Michael J. Jenkins, forest entomology; Raymond I. Lynn, phycology, microbial ecology; Frank J. Messina, insect ecology; Richard J. Mueller, plant anatomy and development; Gregory J. Podgorski, developmental biology; Peter C. Ruben, neurobiology; Kimberly A. Sullivan, behavioral ecology; Dennis L. Welker, molecular biology; George W. Welkie, plant nutrition; Adjunct Associate Professors Jay B. Karren, entomology; Leila M. Shultz, plant taxonomy; Vincent J. Tepedino, entomology; Richard C. Wang, plant cytogenetics; Research Associate Professors Bill B. Barnett, virology; Darwin L. Sorensen, aquatic microbiology; Assistant Professors Bradley R. Kropf, plant pathology; John M. Sterk, microbial ecology; Dana K. Vaughan, physiology, cell biology, neuroscience; Paul G. Wolf, population genetics, molecular systematics; Research Assistant Professors Joanne E. Hughes, molecular biology; Martin G. Klotz, molecular plant pathology; Anuradha Singh, plant growth and development; Principal Lecturers David M. "Andy" Anderson, medical technology; Lecturer Alice M. Lindahl, invertebrate ecology

Degrees offered: Master of Science (MS) and Doctor of Philosophy (PhD) in Biology and Biology Ecology

Specializations: Animal Behavior and Neurobiology, Developmental Biology, Entomology, Microbiology, Molecular Biology, Physiology (Animal, Microbial, Plant), Plant Pathology, Plant Systematics, Toxicology, Vertebrate Zoology

Admission Requirements

See general admission requirements on pages 25-26. To be recommended for matriculated status, an applicant must have earned a bachelor's degree (or equivalent) from an accredited institution and a Biology faculty member must have agreed to serve as major professor for that applicant. The Department of Biology also considers these guidelines for admission: (1) the transcript should show a minimum GPA of 3.0 (B) and (2) the sum of percentile scores on the verbal, quantitative, and analytical portions of the GRE should be at least 150, with none below the 40th percentile. Analytical and advanced (especially biology) are also recommended. Applicants for whom English is not the primary language must have scored at least 550 on the TOEFL. The applicant's undergraduate program should be similar to that offered by the Biology Department of Utah State University, which includes the following and their prerequisites: general biology, microbiology, genetics, ecology, physiology, cell biology, developmental biology, and evolution; general and organic chemistry; calculus; and physics. Other preparatory courses may be specified by the student's supervisory committee. They will vary depending on the area of specialization selected and the background of the specific student.

Course Requirements

Course requirements are determined by the student's supervisory committee.

Research

The Department of Biology provides a dynamic and broad base for research and graduate study through a balanced program of basic and applied studies at ecosystem, population, organismal, cellular, and molecular levels. An outstanding variety of field sites, animal, plant, and microbe growth facilities, and modern well-equipped laboratories are available. Also the Intermountain Herbarium, an excellent insect collection, and a state-of-the-art electron microscope facility exist as research and support facilities.

Faculty members participate in and are supported by several interdepartmental programs, including: the Utah Agricultural Experiment Station, the Ecology Center, the Molecular Biology Program, the Biotechnology Center, and the Center for Environmental Toxicology. In addition, many less formal contacts and interactions exist with colleagues in the Colleges of Agriculture, Natural Resources, and Science.

Students are encouraged to carefully consider how their career goals match the faculty's research interests. Because of the combination of a broad interdisciplinary base and excellent focused research programs, students
have an opportunity to learn the philosophies and methods of many branches of biology.

Financial Assistance

Research assistantships are available from the grants of major professors and from Utah Agricultural Experiment Station funds. Teaching assistantships are awarded annually. All awards are made on a competitive basis and specific teaching needs are considered in awarding teaching assistantships. Given satisfactory performance, MS students are supported for two years and PhD candidates for three years on teaching assistantships. The department may also recommend particularly qualified students for college or University fellowships. Admission to the graduate program of the Biology Department does not guarantee financial support.

Career Opportunities

Completion of graduate degrees in Biology prepares students for careers in teaching and research in universities and colleges. Many graduates also find employment with private industry and state and national governmental agencies. Specific employment possibilities will depend on the nature of the graduate program pursued. The extensive background provided by a graduate degree also prepares students for eventual administrative responsibilities.

Biology Courses

505. Radiological Health and Safety. Required for authorization to utilize radioactive materials at USU, this course introduces the concepts of fundamental radioactivity, radiation detection, radiology, and practical health physics. Prerequisites: Phys 113 and Biol 125. (3F,Sp)

507. Elementary Models in Ecology. Elementary models in population and community ecology explored through computer simulation. Random and deterministic populations, competition, predation, food webs, and islands. No programming required. Prerequisite: a course in ecology. (3W)

516. Methods in Biotechnology: Cell Culture. Laboratory-intensive course in basic and applied methods of culturing cells (mammalian, insect, plant) and methods of fusion and transforming cells. Prerequisites: Biol 125 or ADSVS 316 or equivalent, or permission of instructor. (3W)

519. Molecular Genetics. Molecular aspects of genetics, including DNA replication, structure, rearrangement, transportation, recombination, repair, genetic engineering, and gene expression. Prerequisites: Biol 319 and a course in biochemistry. (3W)


523. Developmental Biology. Study of the subcellular, cellular, and tissue-level phenomena that result in integrated organisms, using plant, animal, and microbial models. Mechanisms, rather than descriptions, will be emphasized. Prerequisites: Biol 319 and 521, or permission of instructor. (3F)

524. Methods in Biotechnology: Protein Purification Techniques. Laboratory-oriented course designed to provide basic knowledge in protein purification, analysis, and its scale up. Prerequisites: Chem 370 or ADSVS 316, or permission of instructor. (3Sp)

525. Evolutionary Biology. Current developments in evolutionary biology. Considers topics from molecular to macroevolutionary scales. Prerequisite: Biol 319 and 386, or permission of instructor. (3W)

526. Methods in Biotechnology: Molecular Cloning. Laboratory-oriented course in molecular cloning techniques such as DNA cloning, genetic probes, PCR, DNA sequencing. Prerequisites: Chem 370 or Biol 319 and Mircr 301 or equivalent, ADSVS 316, or permission of instructor. (3P)

533. History of Biology. Historical development of the biological world view from primitive animism to modern reductionism, with emphasis on the origins and impact of major biological theories. (3Sp)

540. Microcomputers in Biological Research. Use of microcomputers in biological research as applied to research design; data acquisition; data storage, manipulation, graphical display; interfacing peripherals. Prerequisite: at least one upper-division biology course. Two lectures, one lab. (3W)

564. Techniques of Electron Microscopy. Applications of techniques used in preparing samples for electron microscopy and those necessary for examination and photography with the transmission electron microscope. One lecture, two labs. (3Sp)

576. Modeling Biological Systems. Introduction to mathematical and computer modeling of biological systems, emphasizing ecological systems. Prerequisites: Math 216 or 221, at least one upper division course in Natural Resources or Biology, Stat 301, and computer programming or permission of instructor. Three lectures, one recitation. (4P)

587. Modeling Forest Dynamics. Theory and methods of forest succession modeling. Analysis and construction of tree and forest ecosystem simulation models. Emphasis on methods and application. Prerequisites: General Ecology, Math 215, Stat 301, CS 241, or permission of instructor. (3F)

617 (d517).1 Introductory Population Genetics. Theoretical and applied aspects of population genetic structure, mating systems, selection, mutation, gene flow, genetic drift, molecular evolution, quantitative and conservation genetics. Prerequisite: Biol 319 or consent of instructor. (3W)

618. Molecular Population Genetics Laboratory. Application of molecular techniques to population genetics, ecology, and systematics. Includes experimental and sampling design, and data analysis. Prerequisite: Biol 617/617 or permission of instructor. (5F)

621. Advanced Cell Biology. In-depth study of selected aspects of structure, function, and organization of cells. Topics in current literature will be emphasized. Prerequisite: Biol 521 or permission of instructor. (4Sp)

625. Graduate Internship/Co-op. A professional level internship cooperative education experience in biology for graduate students. (1-9F, W,Sp,Su) (3F)

630. Evolutionary Ecology. Contemporary topics in evolutionary ecology with emphasis on life history evolution. Two lecture/discussions. Prerequisite: Biol 386 or permission of instructor. (3W)

632. Modeling Ecological Systems. Advanced treatment of mathematical and computer modeling of ecological systems, emphasizing ecosystem analysis. Prerequisites: Biol 386 and 576, Math 221 or equivalent, Stat 301 and programming experience or permission of instructor. Three lectures, one recitation. (4W)

640. Radiotracer Techniques. Techniques for use of radioactive tracers in biological research. Prerequisite: Biol 505 or Phys 505 or permission of instructor. (2W)


652. Scanning Electron Microscopy. Techniques employed in preparation of biological and nonbiological samples for observation of material with the scanning electron microscope and X-ray detector. (3Su)

663. Transmission Electron Microscopy. Theories and techniques necessary for operating the transmission electron microscope and examining and recording of data from biological samples. Prerequisite: Biol 521. (3F)

664. Electron Microscope Histology. Theories and techniques employed in the preparation of biological materials for observation with the transmission electron microscope. Prerequisite: Biol 521. (3W)

674. Molecular Biology Laboratory. Molecular biology experiments illustrating general and current principles and mechanisms underlying biological phenomenon and materials. (3Sp)

675. Topics in Biology (Topics). 1-6F, W,Sp,Su (3F)

680. Biology Seminar. Series of lectures by invited off-campus and on-campus speakers sponsored by the Department of Biology. Broad range of topics. (1F,W) (1F)

687. Ecology Seminar. (1F) (1F)

689. Molecular Biology Seminar. 1-6F, W,Sp,Su (1F)

691. Special Problems. Individual or group study under staff guidance. Prerequisite: permission of instructor. (1-6G) (1-6G)

693. Presentation and Publication in the Life Sciences. Tech-
niques of graphic preparation, oral presentations, job interviews, grant preparation, and publication requirements in the life sciences. (3F)


699. Continuing Graduate Advisement. (1-3F, W, Sp, Su)®


799. Continuing Graduate Advisement. (1-3F, W, Sp, Su)®

**Botany Courses**

510. Plant Anatomy. Structure and development as related to function of major cell types and tissues; comparative anatomy of stem, root, leaf, flower, fruit, and seed in angiosperms. Three lectures, two labs. Prerequisites: Biol 125 and 126 or equivalent. (5F)

560. Principles of Plant Pathology. Fundamental principles underlying disease in plants. Prerequisite: Biol 125, 126, or equivalent. (5F)

*563. Forest Pathology. Nature, cause, and control of diseases affecting forest trees. Prerequisite: Bot 560 (may be concurrent). Two lectures, two labs. Also listed as FR 563. (4W)

**562. Ecological Plant Morphology and Anatomy. Modification of basic plant form and internal structure in relation to environmental influences. Effects from phenotypic variation to major adaptations will be discussed. Prerequisite: Bot 510 or permission of instructor. (3W)

**561. Principles and Practice of Plant Systematics. Factors affecting patterns of variation in land plants; research techniques, including data analysis, used in plant systematics; current views on evolution of angiosperms. Prerequisites: Bot 420 and Biol 319 or permission of instructor, biochemistry recommended. Four lectures, one lab. (5F)


**641. Plant-water Relationships. Factors affecting the availability of water, its absorption and use in plants, and the effects of water deficits on plant processes. Prerequisite: Bot 440. (3Sp)

645. Photosynthesis. Biochemical and biophysical processes of photosynthesis from the chloroplast level to primary productivity of plant communities. Prerequisites: Chem 370 and Bot 440 or equivalent. (3Sp)

650. Molecular Events in Plant-Microbe Interactions. The molecular basis of pathogen virulence and host resistance. Prerequisites: Chem 370, 371. Recommended: Bot 440 and 560. (3F)

651. Field Plant Pathology. Utah plant diseases; includes identification, conditions leading to development, and practices leading to disease control. Field trips and laboratories. Prerequisites: Bot 560 or 563; and instructor's consent. (3Sp)

690. Plant Biology Seminar. (1)®

691. Special Problems in Botany. Individual or group study under staff guidance. Prerequisite: permission of instructor. (1-5F, W, Sp, Su)®

692. Plant Pathology Seminar. (1F, W, Sp)®

**Entomology Courses**

530. Insect Taxonomy. Classification, identification of insects to family, including basic external morphology. Collection required. Three lectures, one lab. Prerequisite: Biol 127 or permission of instructor. (4F)

*532. Insect Physiology and Internal Anatomy. Function and structure of the organ systems of insects, illustrating tissue to subcellular coordination of physiology. Three lectures, two labs. Prerequisite: Biol 127. (5W)

534. Insect Ecology. Examines the distribution and abundance of insects in natural and agroecosystems. Topics include population dynamics, life-history adaptations, species interactions, and community structure. Three lectures, one lab. Prerequisites: Insect Biology and Biol 386 or instructor's permission. (4F)

535. Medical and Veterinary Entomology. Arthropods affecting the health of man and other animals. Includes life history, recognition, disease transmission and control. Two lectures, two labs. Prerequisite: Ent 229 or Biol 127. (4W)

537. Aquatic Entomology. Recognition, habitats, adaptations, and life histories of aquatic insects. One lecture, two labs. Prerequisite: basic entomology or permission of instructor. (3Sp)

**540. Forest Entomology. Life histories, ecological relationships, and recognition of major beneficial and harmful forest insects. Two lectures, two labs. Prerequisite: Ent 229 or Biol 125. (4F)

630. Advanced Systematics. Application of systematic principles and rules to taxonomic problems. Two lectures, one lab. Prerequisites: Biol 525, Stat 301. (3W)


638. Insecticide Toxicology. Chemistry of insecticides as related to toxicity, mode of action, and metabolism. Prerequisites: physiology and organic chemistry. (3Sp)

636. Experimental Entomology. Current research methodology in the study of insect life processes. One lecture, two labs. Prerequisites: Ent 532 or 554. (3W)

**637. Theory and Practice of Biological Control. Theoretical and applied aspects of population management of pest insects, mites, and weeds by predators and parasites. Prerequisites: Biol 366, Ent 229 or 441. (3W)

**639. Insect Ecophysiology and Behavior. Detailed survey of physiological and behavioral mechanisms that enable insects to exploit diverse habitats and resources. Prerequisites: Ent 532 or equivalent, Ent 534 previously or concurrent. (3W)

641 (d441). Insect Pest Management. Theory and practice of integrated pest management. Includes recognition, damage, benefits, and control of insects. Three lectures, one lab. Prerequisite: Ent 229 or Biol 125. (4F)

685. Seminar in Entomology. (1F, W, Sp)®

691. Special Problems in Entomology. Individual or group study under staff guidance. Prerequisite: permission of instructor. (1-6F, W, Sp, Su)®

**Microbiology Courses**

*501. Mycology. Taxonomy, morphology, genetics, and physiology of the fungi. Special attention to forms important in agriculture, medicine, and industry. Three lectures, two labs. Prerequisites: Biol 125 and 126 or permission of instructor. (5F)

502. Pathogenic Microbiology. Properties of pathogens and their relationships to infectious diseases. Four lectures, one lab. Prerequisite: Micro 301 or permission of instructor. (5W)

503. Immunology. The immune response in the host animal and immunologic procedures. Prerequisites: organic chemistry, Biol 125, 136, 127, 319, or permission of instructor. (3Sp)

569. Aquatic Microbiology. Principles of microbiology relevant to the aquatic environment. Emphasis on fresh water and waste water. Prerequisite: Micro 111 or 301. (3Sp)

561. Aquatic Microbiology Laboratory. Application of aquatic microbial techniques. Two 1.5-hour labs per week. Prerequisite: Micro 112 or 301 and Micro 560 concurrent or previously. (1Sp)

570. Virology. Structure, replication, genetics, and molecular biology of viruses; virus-host interactions; viral diseases and antiviral agents. Prerequisites: Micro 301 and Biol 319. Micro 401 recommended. (4W)

571. Virology Laboratory. Introduction to laboratory techniques using bacterial and animal viruses. Prerequisite: previous or concurrent enrollment in Micro 570. (2W)

601. Advanced Immunology. Discussion of current topics in cell-mediated and humoral immunology. Prerequisites: Micro 503 or consent of instructor. (2F)

630 (d530). Soil Microbiology. Activities and ecology of microorganisms related to the soil environment, soil fertility, soil organic matter, rhizosphere, and soil amendments. Prerequisites: general biology, organic chemistry. (3W)
631 (d331). Soil Microbiology Laboratory. Application of soil microbiological techniques. Two labs. Prerequisite: Micrb/Soils 630/530 taken concurrently or previously. (2W)

*635. Soil and Environmental Biogeochemistry. Discussion of elemental cycling and biogeochemical processes in the soil and human environment, origin of soil organic matter, and microbial activities at soil interfaces. Prerequisites: Micrb/Soils 630/530 and organic chemistry or permission of instructor. (3Sp)

**670. Advanced Animal Virology. Molecular, biochemical, and genetic analysis of selected viruses and their related diseases. Prerequisite: Micrb 570 or permission of instructor. (3F)

691. Special Problems in Microbiology. Individual or group study under staff guidance. Prerequisite: permission of instructor. (1F, W, Sp) ©

780. Seminar. (1F, W, Sp) ©

**Physiology Courses**

501. Mammalian Physiology I. An intensive, detailed study of membrane physiology, muscle, neurophysiology, sensory physiology, excretion, and body fluids. Prerequisites: Biol 125, 126, 127, 521, Chem 123, 160, and a course in Physics, or permission of instructor. (4F)


503. Endocrinology. Ductless glands and their secretions. Emphasis is placed on the action of these hormones on growth, metabolism, and adaptation of animals to changes in the internal and external environments. Three lectures, one lab. Prerequisites: Biol 125, 126, 127, Physiol 130, and Chem 331, 332. (4Sp)

504. Comparative Animal Physiology. Survey of physiological adaptations of vertebrates and invertebrates to environmental variables and strategies that underlie the evolution of organ systems for excretion, respiration, circulation, digestion, and integration. Prerequisites: cell biology or physiology, chemistry (preferably organic), and introductory physics. (3Sp)

505. Animal Physiology Laboratory. Intensive, hands-on course using classical preparations to train students in experimental design, data analysis, and writing research reports. Prerequisites: Physiol 501 (502 recommended) or 504 or instructor's consent. (2Sp)

*605. Ecological Vertebrate Physiology. Physiological responses and adaptations of vertebrates to the geophysical, geochemical, and biological environment. Bioenergetics at the species level. Four lectures, one lab. Prerequisites: one course in ecology and one course in physiology. (3F)

*620. Physiology of Reproduction. Processes of reproduction in mammals including mechanisms of control. Three lectures, one lab. Prerequisites: Physiol 502, 503, and a course in organic chemistry. (4Sp)

686. Seminar in Physiology. Required of all physiology graduate students each winter quarter while in residence. (1W) ©

691. Special Problems in Physiology. Individual or group study under staff guidance. Prerequisite: permission of instructor. (1F, W, Sp, Su) ©

695. Readings in Physiology. Reading and reporting of classical and current literature in physiology. (1F, W, Sp) ©

**Public Health Courses**

510. Environmental Health. The effect of environment on man's health together with control measures applied. Includes water, air, refuse, industrial hygiene, radiation, insects, and rodents. Three lectures, one lab. Prerequisites: one year each of biology and chemistry, and Micrb 111-112 or 301. (4Sp)

512. Communicable Disease Control. Mechanisms of transmission, control, and prevention of communicable diseases. Prerequisites: Micrb 111-112 or Micrb 301. (3F)

516. Food-borne Disease Control. Principles of food-borne disease transmission, control, and enforcement. Prerequisite: Micrb 111-112 or Micrb 301. (3Sp)

530. Fundamentals of Epidemiology. Introduction to the study of the distribution and causes of communicable and noncommunicable diseases in man and other animals. Two lectures, one lab. Prerequisites: Stat 201 or equivalent, Micrb 111-112 or 301, and Pub H 512 or permission of instructor. (3W)

540. Industrial Hygiene. Fundamentals of industrial hygiene including recognition, evaluation, and control of chemical, biological, and physical agents affecting the health of workers. Three lectures, one lab. Prerequisites: Biol 125, 126, 127, and Chem 123, 160 or permission of instructor. (4F)

541. Industrial Hygiene Instrumentation and Sampling. Practical experience in the application of industrial hygiene field sampling methodologies and utilization of basic sampling instrumentation. Prerequisite: Pub H 540. (3W)

542. Industrial Health Hazards. Specific health-related problems of various industrial processes are addressed, including hazard recognition, exposure assessment, and control approaches. Prerequisites: Pub H 540, 541. (3Sp)

580. Seminar in Health Problems. (1F, W, Sp) ©

691. Special Problems in Public Health. Individual or group study under staff guidance. Prerequisite: permission of instructor. (1F, W, Sp, Su) ©

**Zoology Courses**

551. Invertebrate Zoology. The more important phyla of invertebrates, with some consideration of local fauna. Three lectures, two labs. Prerequisites: Biol 125, 126, 127. (5Sp)

555. Parasitology. Life cycles, clinical significance and taxonomy of medically important worms, arthropods, and protozoa parasitizing humans and, to a lesser extent, domestic animals. Three lectures, two labs. Prerequisites: Biol 125, 126, 127, or permission of instructor. (5Sp)

561. Avian Biology. Structure, function, classification, physiology, behavior, and ecology of birds. Two lectures, one lab. Prerequisites: Biol 125, 126, 127, or permission of instructor. (3W)


573. Herpetology. Classification, distribution, life habitats, and identification of amphibians and reptiles, with emphasis on local forms. Three lectures, one lab. Prerequisites: Biol 125, 126, 127, or permission of instructor. (4Sp)


681. Seminar in Vertebrate Zoology. (1F, Sp) ©

691. Special Problems in Zoology. Individual or group study under staff guidance. Prerequisite: permission of instructor. (1F, W, Sp, Su) ©
Graduate-level courses offered by the department also serve to support the plan of study of graduate students in a wide variety of disciplines.

**Business Administration Courses**

573. Management of Quality. This course develops methods and procedures for design, implementation, and control of TQA (Total Quality Assurance) programs in both product and service organizations. Prerequisite: Stat 230. (3W)

607. Survey of Corporation Finance. Survey of the means which a corporation uses to raise and manage its capital. A study of modern financial principles, methods, and institutions. Prerequisites: Acctg 601, 602; statistics. Taught only in Ogden. (3W)

608. Survey of Marketing. Survey of the background and nature of marketing processes. Analysis of the tasks of marketing management, the behavior of customers, and the functioning of marketing institutions. Prerequisites: Econ 500, 501; Acctg 601, 602, statistics. Taught only in Ogden. (3Sp)

610 (d410). Government Contract Administration. Provides basic information and description of the general environment and context of government contracts (primarily U.S. Government Contracts). Emphasis is on the administration of and accounting for these contracts. (4Sp)

635. Managerial Economics. The integration of economic theory with business practice and policies for the purpose of facilitating decision making and forward planning. Prerequisites: Econ 501 (or equivalent); statistics. Also taught in Ogden, summers of 1995 and 1997. (3F)

642. Finance Problems. An analytic treatment in-depth in selected areas of financial management designed to further the student's understanding of the financial management function and the importance it has to the firm. Prerequisite: first year core. Also taught in Ogden, winter 1996. (4W, Su)

644. Special Topics in Finance. Selected topics in finance are pursued in depth. Topics and instructors will vary from quarter to quarter. Prerequisite: BA 642. (3Sp)

645. Investment Theory. A course in investments and portfolio theory. Topical coverage includes the mathematical basis for portfolio theory. Computer-based analysis required. Prerequisite: BA 642. Also taught in Ogden, spring 1996. (3Sp)

652. Marketing Strategy. An advanced case approach to current marketing management problems. Emphasis on concepts, research, techniques, decision making, and marketing strategy development. Prerequisite: first year core. Also taught in Ogden, winter 1996. (4W, Su)

654. Special Topics in Marketing. Selected topics in marketing are pursued in depth. Topics and instructors will vary quarter to quarter. Prerequisite: BA 652. (3)

672. Operations Management. A study of the basic process functions in managing a production or service organization, such as inventory control, production control, procurement, quality control, production planning, forecasting, etc. Prerequisite: first year core. Also taught in Ogden, spring 1997. (4W, Su)

674. Special Topics in Operations Management. Selected topics in operations management are pursued in depth. Topics and instructors will vary from quarter to quarter. Prerequisite: BA 672. (3)

690. Independent Research and Reading. Also taught in Ogden. (1-5F, W, Sp, Su)®

696. Professional Paper. A paper of professional quality prepared by each student. Designed to demonstrate the ability to complete a major business related project and to effectively present the results. Also taught in Ogden. (4F, W, Sp, Su)


699. Continuing Graduate Advisement. (1-3F, W, Sp, Su)®

760. Seminar in Financial Topics. Doctoral seminar in current finance theory. Topics will include current issues in investments, portfolio theory, corporate finance, capital markets, speculative markets, and financial institutions. (3)

® Repeatable for credit. Check with major department for limitations on number of credits that can be counted for graduation.
Department of

Business Information Systems and Education

College of Business

Head: Professor Lloyd W. Bartholome, business education
Office in Business 711, 797-2342

Graduate Program Director: Associate Professor Charles M. Lutz, business information systems

Professors: James C. Scott, business education; H. Robert Stocker, business information systems; William A. Stull, marketing education; Associate Professors Thomas Hilton, business information systems; Dennis LaBonty, business information systems; Associate Professor Emeritus Floris S. Henderson; Assistant Professors Jeffrey J. Johnson, business information systems; David J. Paper, business information systems

Degrees offered: Master of Science (MS), Master of Education (MEd) in Secondary Education with Specialization in Business Education; the Business Information Systems and Education Department participates in the Interdepartmental Doctoral Program in Education, Doctor of Education (EdD) and Doctor of Philosophy (PhD)


Admission Requirements

Master of Science. Students applying for admission to the Master of Science program in Business Information Systems and Education must take the GMAT test. A score at the 40th percentile or better on the GMAT is required for admission. Undergraduate GPA should be 3.0 or above. Meeting minimum requirements does not guarantee admission. Students entering the MS program who have graduated from business schools not accredited by the AACSB or who have nonbusiness degrees must complete the AACSB Common Body of Knowledge. Only nine credits of the Common Body of Knowledge can be counted toward the MS.

Master of Education. Students desiring admission to the MEd program must also meet the requirements of the Secondary Education Department, College of Education.

Doctor of Philosophy or Doctor of Education. Applicants for admission to the College of Education PhD or EdD program with a specialization in Business Information Systems and Education must take the G.E.E. Scores on the verbal and quantitative test must be at or above the 40th percentile. No minimum score is required on the analytical section (required by the Educational Testing Service).

All students must meet admission requirements as specified by the School of Graduate Studies (see pages 25-26).

Master of Science

The MS requires a minimum of 45 credits for the Plan A option and 54 credits for the Plan C option. Students with a bachelor's degree from institutions not accredited by the American Assembly of Collegiate Schools of Business must complete the AACSB core. A maximum of 9 credits of AACSB core work may be counted in the Plan A or Plan C option. A minimum of 24 credits of academic work must be in classes numbered 600 and above.

Students in the MS may pursue one of two options:

1. The Plan A (thesis) option requires a minimum of 45 credits, including 9 credits for completion of the thesis. Evidence of advanced writing competency must be provided before students are allowed to work toward the Plan A option.

2. The Plan C (nonthesis) option requires a minimum of 54 credits.

All MS degree in the BISE Department require the following core: BIS 615, 640, 641, 645, 650, 655, 670, 681, and 761.

The specialization in Business Information Systems is for students who wish to work as systems analysts, application programmers, information managers, information center managers, and trainers in business information systems.

Students are expected to have a background in business information systems. Required courses are BIS 610, 612, 620, 630, and Stat 502 in addition to the department core. Students who choose the Plan A option must complete 9 credits of BIS 697. Students may take credits in Business Information Systems and Education, Computer Science, Instructional Technology, Business Administration, Accounting, Economics, or other approved electives.

The specializations in Business and Marketing Education are designed for those who are teaching in an area of business. A sequence of courses is available during the regular school year or during the summer. If students attend summers only, they should plan a minimum of three to four summers to complete the degree. BIS 672 and 766 are required in addition to the department core. Students who choose the Plan A option must complete 9 credits of BIS 697. Students may take credits in Business Information Systems and Education, Computer Science, Instructional Technology, Business Administration, Communication, Economics, Secondary Education, or Psychology, or other approved electives.

The specialization in Training and Development is for students who wish to work in training and develop-
lement in business and industry. Required courses are BIS 635, 672, and Psy 601 in addition to the department core. Students must choose 9 credits from Ins T 627, 628, 635, 637, 644, 677, 678, Psy 606, and MHR 609. Students who are approved for the thesis option must complete 9 credits of BIS 697. Students may take credits in Business Information Systems and Education, Computer Science, Instructional Technology, Business Administration, Communication, Economics, Secondary Education, Psychology, or other approved electives.

Master of Education

The MEd degree in secondary education with specialization in business education has a master's project requirement as part of the program. The total program of 54 credits is devised specifically for the practicing secondary school teacher of business or marketing education. Students complete a core area in secondary education as well as requirements in business education and subject-matter-oriented courses. The program is also designed to prepare people to teach in public secondary schools.

The USU program is one of the top-ranked programs in the United States, as well as the only master's program in Business Information Systems in the State of Utah. Graduates are placed in the West and throughout the nation.

Doctor of Philosophy and Doctor of Education

The Department of Business Information Systems and Education cooperates with other departments in offering the Doctor of Philosophy (PhD) and Doctor of Education (EdD) with concentrations in business education, marketing education, business information systems, and business communications. Other subject matter options are also available. The PhD is a research-based degree. The EdD degree is a practitioner's degree. Both degrees require dissertations. Graduates secure positions teaching business subjects or business-teacher education in colleges and universities or in business and industry. Former graduates are currently in various positions in higher education, including higher education administration; in teacher education instruction; and in business and industry.

Additional Information

Specific details about each of the foregoing degree programs are outlined in policy and procedure documents available through the department. All requirements are subject to change; check with the department for current requirements.

Research

Faculty in the Department of Business Information Systems and Education are active in research and scholarly endeavors. Current and published research topics include business communications, international communications, improvement of instruction in teaching, business information systems as related to business and industry, curriculum for business schools, records management, video disc technology as related to business information systems, microcomputer applications, use of microcomputers in various subjects including accounting and business communications, cooperative education, issues in higher education, and other areas related to business information systems, marketing education, and business education.

Financial Assistance and Assistantships

Funds for scholarships are provided through the School of Graduate Studies and administered in the department. Those interested in scholarships should contact the graduate director or the department head.

Each year several high-quality graduate teaching assistants are needed. These assistants generally teach classes in keyboarding, word processing, business communications, and microcomputer applications. Those who are interested in teaching assistantships must apply through the department head. They must have had experience teaching or be willing to take teaching methods classes prior to receiving an assistantship.

Business Information Systems and Education Courses

510. Business Information Systems Projects. Design and development of a complete, integrated microcomputer applications system to meet the information needs of a specific business situation. Prerequisites: BIS 340, 410, and 440 or permission of instructor. (4)

515. Decision Support Systems. Designed to prepare business information specialists. Role of the microcomputer in information management and developing familiarity with available microcomputer software which supports business decision systems. Prerequisites: BIS 140, 310, 340; Stat 230 or Psy 380, or equivalent. (3)

520. Local Area Network Management for Business. Applications of networking concepts related to the management of local area networks. Includes topics related to repair, setup, management, and maintenance of local area networks. Prerequisites: BIS 310 and 340. (3)

530. Internet Management for Business. Installation and setup of software to utilize Internet services. Services covered include: e-mail, ftp, gopher, telnet, world wide web, and Usenet News. Prerequisite: BIS 230. (3)

541. Managing Information Technology in Business. Introduces current technologies which impact upon managing business information. Participants will learn about equipment, applications, and management skills which lead to increased productivity. (3Sp.Su)

561. Business Education/Marketing Education Curricula and Student Organizations. Study of business and marketing education with emphasis on the product life cycle. (3)

570. Management of Global Information Systems. Management issues inherent in the global information systems function. Emphasis on elements that make global information systems management different from other organizational functions. (3)

572. Methods of Teaching Business and Marketing Education. Methods of teaching as applied to business and marketing education. Courses include general business, business law, business principles, accounting, marketing, and merchandising. Prerequisites: Acctg 201, 203, BA 350, and admission to teacher education. (3)

573. Methods of Teaching Keyboarding and Microcomputing. Psychological principles and methodology for teaching keyboarding, microcomputing, and computerized accounting. Includes microcomputer equipment, teaching laboratory needs, classroom management, and lesson planning. Prerequisites: BIS 112, 140, and admission to teacher education. (3)

595. Independent Readings. (1-5)

610. Business Information Systems Analysis. Business information systems analysis and logical systems specification. Iterative nature of systems analysis, and both unstructured and automated analysis tools. (3)

611. Workshop. Intensive one- or two-week workshop. (1-3)

612. Business Information Systems Design. Formalization of the business information systems design process. Students use automated design
tools to solve a real-world information systems problem. Prerequisite: BIS 610. (3)

615. Communications for Business. In-depth study of the process for preparing written business communications and related oral presentations. Reports relevant to the student's major will be prepared. Prerequisite: BIS 255 or equivalent. (3)

620. Business Data Communication Systems. Introduction to business data communications to include concepts, network architecture, data communication software and hardware, distributed information systems, and business communication system services. (3)

625. Business Internship. For the practicing teacher who wishes to upgrade his or her experience in an occupational field related to teaching assignment. One credit per 50 hours of experience. (1-6)

630. Database Management Systems. Use of database systems on standard computer hardware. How data resources can be managed to support effective information systems in organizations. Prerequisite: BIS 310, 670, or equivalent. (3)

635. Designing and Managing Business Training Programs. Designed to familiarize students with the process of developing, implementing, and managing training programs in business. Emphasis on integration of training and management of this activity in organizations. (4)

640. Microcomputer Applications in Business. Provides concepts basic to integration of microcomputers into a business organization by operating microcomputers for data processing and word processing for business applications. Prerequisite: BIS 140 or equivalent. (3)

641. Emerging Business Information Technologies. Applies emerging business information technologies to enhance business operations. Participants will utilize equipment, applications, and management skills to lead to increased business productivity. (3Sp,Su)

645 (d545). Computerized Business Presentations. Designed to utilize computerized presentation capabilities. Participants will use computers to generate and deliver effective presentations. Prerequisite: BIS 340. (3)

650. Microcomputer Business Systems. Projects course designed to provide students with advanced knowledge of the use of microcomputers in business with emphasis on database management. Prerequisites: BIS 140 or equivalent and programming course. (3)

655. International Business Communication. Culture-general and culture-specific study of business communication in the diverse world of international business from both theoretical and applied perspectives. (4)

660. Business Teaching Internship. Graduate-level business teaching experience at approved secondary or postsecondary institution. (1-3)

662. The Business Curriculum. Principles, concepts, methods, and procedures of studying, changing, and constructing of business offerings in the secondary schools and colleges. (3)

670. Information Systems Resource Management. Designed to prepare managers of business information systems. How to acquire, organize, monitor, and control BIS resources and management problems using computerized information systems. (3)

672. Improvement of Instruction in Business. Designed for experienced business teachers or for those who are employed as trainers in a business, industrial, or public environment. Emphasis on identifying and implementing effective instructional techniques. (3)

673. Improvement of Instruction in Typewriting and Business Microcomputing. Basic factors of skill and improvement of methods and techniques in typewriting and microcomputing for the experienced business teacher. (3)

676. Cooperative Programs in Business and Marketing Education. Programs in business and marketing education. Techniques for organizing and administering cooperative education programs at the secondary and postsecondary level. Designed for the experienced teacher. (3)

677. Competency-based Instruction. Business teachers learn how to develop competency-based instruction by completing a CBI project. (3)

681. Research and Proposal Writing. An analysis of the research methodology applicable to the business information systems and business/marketing education areas. Students develop and complete research for creative proposals. Repeatable once for credit. (3)

695. Independent Readings. (1-5)

697. Master's Paper. Master's level thesis or Plan B research credit. (1-9)

699. Continuing Graduate Advisement. (1-3)

725. Graduate Research Internship. For doctoral students desiring to improve their research capability. Prior approval required. Repeatable to a maximum of six credits. (1-3)

733. Supervision Internship. Follows Educ 732. (3-12)


766. Postsecondary/Adult Business Programs. Postsecondary education for business programs. Emphasis on structure and objectives of programs, types of students attracted, and procedures for operating, maintaining, and evaluating business programs. (3)


781. Research Seminar. Identification of a research problem, consideration of research strategies and methods, applications of research and statistical concepts in departmental focus, and interaction with doctoral faculty. (1)

795. Independent Readings. (1-5)


799. Continuing Graduate Advisement. (1-3)

® Repeatable for credit. Check with major department for limitations on number of credits that can be counted for graduation.

*Taught 1995-96.

*Taught 1996-97.
Department of
Chemistry and Biochemistry

College of Science

Head: Professor Vernon D. Parker, organic chemistry
Office in Maeser Laboratory 106, 797-1619

Associate Head: Professor Richard K. Olsen, organic chemistry
Office in Maeser Laboratory 211, 797-1625

Professors Steven D. Aust, biochemistry; Stephen E. Bialkowski, analytical chemistry; William H. Scouten, biochemistry; Edward A. McCullough, Jr., physical chemistry; Professors Emeriti William M. Moore, physical chemistry; Grant Gill Smith, organic chemistry; Jack T. Spence, inorganic chemistry; Associate Professors Ann E. Aust, biochemistry; David Farrelly, physical chemistry; John L. Hubbard, inorganic chemistry; Michael E. Wright, organic/polymer chemistry; Associate Professor Emeritus Thomas M. Farley, biochemistry; Assistant Professors Danny J. Blubaugh, biochemistry; Robert S. Brown, analytical chemistry; Mitchell S. Chinn, inorganic chemistry; Eric D. Edstrom, organic chemistry; Scott A. Ensign, biochemistry; Richard C. Holz, inorganic chemistry; Lance C. Seefeldt, biochemistry; Greg M. Swain, analytical chemistry; Research Assistant Professor Thomas A. Grover, biochemistry

Degrees offered: Master of Science (MS) and Doctor of Philosophy (PhD) in Chemistry and in Biochemistry

Specializations: Analytical, Inorganic, Organic, and Physical Chemistry; Biochemistry/Molecular Biology

Admission Requirements

See general admission requirements, pages 25-26.

Degree Programs

Master of Science. To gain an MS in chemistry, biochemistry, or biochemistry/molecular biology, a student must meet the general requirements of the School of Graduate Studies (see pages 26-30), conduct research under the direction of a major professor, write a thesis acceptable to a supervisory committee, and pass a final oral examination, primarily a defense of his or her research and thesis.

Undergraduates who meet the qualifications may be able to gain both the BS and MS degrees in chemistry or biochemistry within five years by entering a special program at the beginning of the fourth academic year. In this program, greater time and emphasis are placed on research than in the normal undergraduate program.

Doctor of Philosophy. To gain a PhD in chemistry, biochemistry, or biochemistry/molecular biology, a student must successfully complete a core curriculum and fulfill other course requirements; pass examinations (oral for the biochemistry degree, both written and oral for the chemistry degree) in a field of specialization; conduct research and write a dissertation acceptable to a supervisory committee; and present a seminar and oral defense of his or her thesis.

Course Requirements

Every graduate student in chemistry must successfully take physical chemistry (Chem 601), organic chemistry (Chem 625), inorganic chemistry (Chem 650), and analytical chemistry (Chem 662). Students who have sufficient background may be excused from a core course on the recommendation of the Graduate Studies Committee.

Biochemistry students must successfully complete biochemistry (Chem 670 and 671), molecular biology (Chem 672), physical biochemistry (Chem 676), seminar, and at least five additional advanced courses as approved by the supervisory committee. Biochemistry/molecular biology students must successfully complete the coursework described above for the biochemistry degree, along with fulfilling the course requirements specified for the Interdepartmental Program in Molecular Biology.

Chemistry and Biochemistry Courses

516. Methods in Biotechnology: Cell Culture. Laboratory-intensive course in basic and applied methods of culturing cells (mammalian, insect, plant) and methods of fusing and transforming cells. Prerequisites: Biol 125 or ADVS 316 or equivalent, or permission of instructor. (3W)

524. Methods in Biotechnology: Protein Purification Techniques. Laboratory-oriented course designed to provide basic knowledge in protein purification, analysis, and its scale up. Prerequisites: Chem 370 or ADVS 316, or permission of instructor. (3Sp)

526. Methods in Biotechnology: Molecular Cloning. Laboratory-oriented course in molecular cloning techniques such as DNA cloning, genetic probes, PCR, DNA sequencing. Prerequisites: Chem 370 or Biol 319 and Micrb 301 or equivalent, ADVS 316, or permission of instructor. (3F)

533. Advanced Synthesis Laboratory. A laboratory course in practical synthetic methods requiring advanced technique; inert atmosphere, vacuum line, tube furnace, etc. Prerequisites: Chem 335, 352, Chem 311 concurrently. (2Sp)

552. Advanced Inorganic Chemistry. Study of the elements and their compounds. Structure/bonding/properties relationships and stereochemistry of inorganic compounds. Prerequisites: Chem 306 and 351. (3F)

564. Instrumental Analysis. Theory and application of physical-chemical methods of analysis. Selected electrochemical and optical methods. Prerequisites: Chem 308, 360, 361. (3W)

565. Instrumental Analysis Laboratory. Laboratory course to accompany Chem 564. Two four-hour labs per week. Prerequisites: Chem 308, 361. (2W)

600. Chemical Kinetics. Theory of reaction rates with application to current research problems. Prerequisite: Chem 307. (3F)

601. Quantum Chemistry. Quantum mechanics applied to chemical problems: theory of atoms and molecules. Prerequisites: Chem 308, Math 321 or 322. (3W)

602. Molecular Spectroscopy and Structure. Molecular electronic structure, introduction to infrared, ultraviolet, Raman, and magnetic resonance spectroscopies. Prerequisite: Chem 601. (3Sp)
625. Advanced Organic Chemistry. Physical organic chemistry. Prerequisite: Chem 308 and 333. (3F)

626. Advanced Organic Chemistry. Stereochemistry, carbonyl group chemistry, and a survey of organometallic chemistry. Prerequisite: Chem 625. (3W)

627. Advanced Organic Chemistry. Organic synthesis. Prerequisite: Chem 626. (3F,Sp)

629 (F329). Plant Molecular Biology. Comprehensive course dealing with the unique biochemical, physiological, and cell biological properties of plants. Topics will include carbon, nitrogen, photosynthetic, and energy metabolism. (4F)

649. Chemical Applications of Group Theory. Introduction to symmetry point groups and theorems of group theory for semiquantitative application to structure, bonding, and spectra. Some familiarity with linear algebra is recommended. Ten lectures, first two weeks of quarter. Prerequisite: Chem 308. (1F)

650. Reactivity and Mechanisms in Inorganic Chemistry. Inorganic reactions and mechanisms. Chemistry of main group and transition elements relevant to contemporary inorganic transformations. Unique chemical, structural properties, and bonding models will be emphasized. Infrared and multinuclear NMR spectroscopic methods will provide a focus for characterization. Prerequisites: Chem 308, 552. (3F)

*651. Coordination Chemistry. Chemistry of the transition metals. Werner complexes, structure and bonding, reactivity and reaction mechanisms. Spectroscopic methods. Prerequisites: Chem 308, 532, 649. (3F)

662. Analytical Chemistry. Prerequisites: Chem 308, 564, 565. (3Sp)

670. Principles of Biochemistry. A study of the chemical and physical behavior of biologically important compounds with an emphasis on protein structure and function. Five lectures. Prerequisites: Chem 301 or 308, 332 and 370, or permission of the instructor. (5F)

671. Principles of Biochemistry. The chemistry of life processes and the metabolism of biologically important compounds, including bioenergetics. Prerequisite: Chem 670 or permission of instructor. (4W)

672. Principles of Biochemistry. A study of the chemical and physical behavior of nucleic acids, with emphasis on structure, function, and biosynthesis. Prerequisite: Chem 670 or permission of instructor. (3Sp)

*676. Physical Biochemistry. Physical methods for the study of macromolecule structure and function which include EPR, NMR, UV-Vis, Mossbauer, EXAFS, and related spectroscopic techniques. Prerequisites: Chem 308, 670, 671, and 672. (3W)

689. Molecular Biology Seminar. (1F,W,Sp,Su)

691. Special Problems in Chemistry and Biochemistry. Selected problems in chemistry and biochemistry. (1-6F,W,Sp,Su)


699. Continuing Graduate Advisement. (1-3)®

*701. Chemical Thermodynamics. From the standpoint of Gibbs. Prerequisites: Chem 308, Math 322. (3F)

*702. Statistical Mechanics. Prerequisites: Chem 601, 701. (3Sp)

*705. Atmospheric Chemistry and Photochemistry. To provide the principles that will enable a student to understand the chemistry and photochemistry of the atmosphere. (3W)


*731. Heterocyclic Compounds. A survey of the chemistry of aromatic heterocyclic substances with emphasis on structure and reactivity. Prerequisite: Chem 627. (3F)

733. Special Topics in Organic Chemistry (Topic). Current topics in organic chemistry. Prerequisite: Chem 627. (3F)®

*753. Special Topics in Inorganic Chemistry (Topic). Topics of current interest in inorganic chemistry. Prerequisite: Chem 650 or 651 recommended. (2-3)®

*760. Analytical Spectroscopy. Principles and application of spectroscopic instruments and methods as they apply specifically to the quantitative analysis of materials. Course is application oriented. (3Sp)

*761. Analytical Separations. Methods available for separation of various components of complex chemical mixtures; identification and quantification of those components; chromatographic techniques, basis of operation; limitations and application of chromatographic methods. (3W)

*762. Electrochemistry. Kinetics and thermodynamic basis of various electrochemical processes; applications of these principles to qualitative and quantitative analytical methods. (3W)

764. Special Topics in Analytical Chemistry (Topic). Prerequisites: Chem 308, 564, 565. (3)®

777. Special Topics in Biochemistry (Topic). Topics of current interest in biochemistry. Prerequisites: Chem 670, 671, 672, or consent of instructor. (2-3F,W,Sp)®

780. Seminar. (1F,W,Sp)®


799. Continuing Graduate Advisement. (1-3)®

*Taught alternate years (see department).
® Repeatable for credit. Check with major department for limitations on number of credits that can be counted for graduation.
 Parenthetical numbers preceded by an f are the former course numbers.

Department of
Civil and Environmental Engineering

College of Engineering

Head: Professor Loren R. Anderson, geotechnical engineering
Office in Engineering Laboratory 211, 797-2932

Graduate Program Coordinator for Geotechnical Engineering: Associate Professor Joseph A. Caliendo, geotechnical engineering; Graduate Program Coordinator for Environmental Engineering: Professor Ronald C. Sims, hazardous waste management; Graduate Program Coordinator for Structural Engineering: Professor Muzz Yener, structural engineering and mechanics; Graduate Program Coordinator for Transportation Engineering: Associate Professor Prianka N. Seneviratne, transportation engineering; Graduate Program Coordinator for Water Engineering: Professor J. Paul Tullis, hydraulic modeling, hydraulic transients
Professors A. Bruce Bishop, engineering systems and planning; David S. Bowles, risk assessment, hydrology, water resources engineering; Vance T. Christiansen, structural analysis and design; R. Ryan Dupont, biological waste treatment; William J. Grenney, Advanced Center for Transportation Studies; Daniel H. Hoggan, hydrologic and hydraulic modeling; Trevor C. Hughes, water resources systems analysis; L. Douglas James, hydrology, water resources planning; Roland W. Jeppson, numerical modeling; Upmanu Lall, climate modeling, statistical hydrology, water resource systems; William J. Rahmeyer, hydraulics, hydraulic structures, scour and erosion; Professors Emeriti Jay M. Bagley, hydrology, water resources; W. O. Carter, structures; Calvin G. Clifton, fluid mechanics and groundwater; William A. Cordon, concrete; Irving S. Dunn, geotechnical engineering; Gordon H. Flammer, hydraulics; C. Earl Israelson, hydrology, hydraulics, water resources, erosion control; Fred W. Kiefer, Jr., geotechnical engineering; Elliot Rich, structural engineering; J. Paul Riley, water resources systems, hydrology; Reynold K. Watkins, geotechnical engineering; Adjunct Professors Vijay K. Gupta, scientific hydrology; Jeffrey R. Keaton, geotechnical engineering, engineering geology; Norman E. Stauffer, Jr., engineering hydrology and computer modeling; Associate Professors William J. Doucette, environmental analytical chemistry; Thomas B. Hardy, ecological system modeling, statistical analysis; Marian W. Kemblowski, groundwater, numerical modeling; Audrey D. Levine, wastewater, characterization treatment; Michael J. McFarland, environmental engineering; Wende A. O'Neill, GIS, transportation engineering; David K. Stevens, treatment process analysis; J. Derle Thorpe, engineering materials, measurements; Gilberto Urroz-Aguire, hydraulics, hydraulic structures; Kevin C. Womack, structural mechanics; Research Associate Professor Darwin L. Sorensen, aquatic microbiology; Adjunct Associate Professors Christopher J. Duffy, groundwater hydrology; Alan T. Herlihy, aquatic chemistry; Philip R. Kaufmann, watershed hydrology; Adjunct Research Associate Professor Witold F. Krajewski, hydrology/climatology; Assistant Professors Marvin W. Halling, structural dynamics, earthquake engineering; Daniel P. Smith, anaerobic biological processes; David G. Tarboton, hydrology and water resources; Adjunct Assistant Professors Edwin L. Smith, structural mechanics; Edward Wolcott, structural mechanics; Affiliated Faculty Robert W. Hill, professor; John E. Keith, professor; Jack Keller, professor emeritus; Jeffrey J. McDonnell, adjunct assistant professor; Michael P. O'Neill, assistant professor; Wynn R. Walker, professor

Degrees offered: Master of Engineering (ME), Master of Science (MS), Civil Engineer (CE), Doctor of Philosophy (PhD)


The ME emphasizes professional practice and coursework. A minimum of 45 credits of technical and scientific coursework is required, including a 3-credit special problems course in which several engineering reports are prepared. The MS emphasizes research and the preparation of a significant publication. A minimum of 36 credits of coursework and 9 credits of thesis research is required for an MS. In special cases, as decided by the student's supervisory committee, two other options are available: (1) Plan B, which requires 45 credits, including 3 credits of CEE 697, Thesis Research, and (2) a coursework-only option. Plan C requires 51 credits of technical coursework, English 305 or its equivalent, and an oral presentation. The CE requires a minimum of 90 credits beyond the bachelor's degree, or 45 credits beyond the MS degree, including a thesis. The PhD represents high scholarly achievement demonstrated by independent research and competence in an area of specialization approved by the student's supervisory committee.

Admission Requirements

See general admission requirements, pages 25-26. Admission committees consider GRE scores and experience, undergraduate record and curriculum, and formal recommendations. A student without undergraduate civil and environmental engineering background may be required to complete selected undergraduate courses prior to admission as a fully matriculated graduate student.

Specializations

Structural Engineering. The structural engineer is concerned about the safety, efficiency, and feasibility of all types of structures. Bridges, dams, power plants, and buildings of ordinary and unusual nature, as well as structures for aircraft, for ship and space industries, and for a great variety of other purposes all depend on the structural engineer for analysis and design. He or she has to evaluate the loads, compute their effects on the structure, and select appropriate materials and shapes. In addition to temperature, residual, and construction effects, the loads may be static or dynamic in nature.

Mathematics, mechanics of materials, and properties of materials constitute a foundation for structural analysis. This is reinforced with knowledge and experience obtained in design courses. Graduate students in this program also engage in structural mechanics and numerical methods as a basis for the analysis and design of complex structural forms. Current research in this discipline includes moving mass analysis of airport pavements; soil-pavement-vehicle interaction problems; interactive dynamic analysis and optimized design of bridge structures; reliability-based structural optimization; finite-element-based predictive analysis techniques; educational special and multipurpose interactive software development; analysis and design of steel rod systems; strength design of cold-formed steel structures; connections in thin-walled steel compression elements; CAD application to structural framing systems; knowledge-based expert systems for earthquake-resistant building design; earthquake analysis and design; nondestructive in-place testing of concrete; and durability testing of high-strength concrete containing superplasticizers.

Structural Mechanics. This program is a part of the structural engineering and mechanics specialization. Both areas encompass a wide range of topics with many common areas of study. However, the field of structural
mechanics is more involved with the areas of applied mathematics and engineering physics.

In order to progressively predict the response of structures, this program gives the student sufficient background in developing appropriate mathematical constitutive laws for engineering materials and any stress and strain. This allows graduate students to pursue research in structural mechanics, structural engineering, and geotechnical engineering. Current research in this discipline includes endochronic-plastic modeling and analysis of reinforced concrete structures; constitutive modeling and structural response of composite materials; microstructural constitutive theory; bifurcation analysis of sheet metals damaged by void growth; shear band bifurcation; dynamic instability analysis of structures; predictive analysis of large scale space structures; predictive finite element analysis of prestressed reactor vessels; damage assessment in fiber-reinforced composite structural elements and systems; progressive finite element analysis of underwater tunnels using liner-soil interaction; creep and shrinkage in concrete; and micro-structural constitutive modeling of filler materials.

Geotechnical Engineering. Engineering studies of soils are concerned with the physical and engineering properties of soils and how these are related to engineering projects.

Traditional geotechnical engineering includes the application of engineering principles to the analysis and/or design of building foundations, earth embankments, retaining walls, drainage systems, earthquake motion, buried structures, and other systems involving soil and rock. Engineers and architects cannot ignore the problems of investigating properties of soils in connection with engineering construction. Undergraduate and graduate courses offered by the department provide the basic knowledge necessary for the design of foundations and various types of earth structures. Fundamental concepts and their application are emphasized so that the student will be properly trained for his or her initial job, as well as being prepared to understand future development in this field.

The Geotechnical Engineering Division, in cooperation with the Environmental Engineering Division, is offering a new program in Geoenvironmental Engineering. This new program uses the strengths of both divisions to provide a program involving the geotechnical aspects of hazardous waste management, the investigation of hazardous waste containment systems, and the design of hazardous waste containment systems.

The geotechnical division has a strong research program. Current research projects in this division include studies on liquefaction, seismic slope stability, pile foundations, landslides, mechanically stabilized embankments, risk analysis of dams, finite element analysis of soil-structure systems, and the long-term properties of clay soils used in hazardous waste containment systems.

Water Engineering. The Water Division embraces strong academic programs in fluid mechanics and hydraulics, groundwater, hydrology, and water resources engineering. Faculty members are nationally and internationally renowned. They are very active in research and in professional organizations, and are in demand for consulting activities. Also, they are highly committed to guiding students through their research and coursework programs.

Graduate students have the opportunity for research support through the Utah Water Research Laboratory (UWRL) while working on theses or dissertations.

Fluid Mechanics and Hydraulic Engineering. The fluid mechanics and hydraulic engineering specialization covers both fundamental principles and theory and their applications in a variety of engineering fields. Elementary fluid mechanics is based on fundamental principles of conservation of mass, the energy and momentum principles, and is the logical core for all water-related engineering programs. Consequently, other specialties in water engineering, such as hydrology, water resources, groundwater, environmental engineering, irrigation, drainage, geotechnical engineering, and watershed science study fluid mechanics. Students specializing in fluid mechanics and hydraulics emphasize theoretical fluid mechanics, hydraulic design, numerical methods, and laboratory hydraulic techniques.

A good variety and balance of courses and supporting research in theoretical fluid mechanics, open channel hydraulics, hydraulic design, transients, sedimentation, municipal water system design, cavitation, and porous media are available at the graduate level. Graduates from the fluid mechanics and hydraulics program find employment in a broad range of professional engineering fields, including private consulting, university teaching and research, and government service.

Groundwater. The groundwater emphasis is concerned with the transport of fluids in the subsurface environment. It encompasses the theory of flow in porous media, groundwater hydrology and hydraulics, water transport of contaminants in subsurface, and analytical and numerical modeling of such processes. Emphasis is placed on the quantitative analysis of the physical and chemical principles governing these processes and on the application of these principles to practical field problems with all their difficulties related to the complex structure of subsurface formations. Examples of such problems include groundwater supply and management, subsurface cleanup technologies, and analysis and remediation of groundwater contamination. These problems are of a multidisciplinary nature, and their solutions require a multidisciplinary approach, involving, among others, soil and water chemistry, chemical engineering, and economics. The groundwater professional is an important team player in solving such problems.

The groundwater program has a strong research component. Current research activities cover a well-balanced variety of topics, from theoretical (e.g., stochastic analysis of transport of contaminants in groundwater) to practical problems (e.g., design of cleanup technologies for gasoline-contaminated sites).

Hydrology. Hydrology is a branch of geoscience that is concerned with the origin, distribution, movement, and properties of the waters of the earth. The hydrologic cycle encompasses the atmosphere, the land surface, lakes and oceans, and the subsurface. Complex, interacting processes at varied time and space scales describe the hydrologic cycle. The concepts and practice of hydrology derive
from an integration of field observations, laboratory investigations, and conceptual, mathematical, chemical, statistical, and probabilistic models.

The hydrology program at USU has strength in both the theoretical and applied aspects of modern hydrology. Past and present research focuses on a broad spectrum of hydrologic problems. These range from climate modeling, rainfall processes, floods, droughts, terminal lake analyses, soil erosion, and stream water quality models to groundwater contamination characterization and remediation, and watershed analyses. Excellent laboratory and computing facilities are available. Strong, continuous state and federal research funding keeps the research topics and facilities current.

The hydrology faculty are committed to a strong academic program. The hydrology curriculum is one of the most comprehensive offered in the U.S. Elements of ongoing research projects are routinely and effectively incorporated into the classes. Students are encouraged to design a degree program that best suits their interests. In addition to the course offerings in the program, a variety of appropriate classes are available through Mathematics and Statistics; Computer Science; Watershed Science; Geography and Earth Resources; Plants, Soils, and Biometeorology; Biology; Chemistry; Physics; Forest Resources; Fisheries and Wildlife; and Rangeland Resources.

**Water Resources Engineering.** The water resources engineer is usually a lead member in water resources planning teams and is often charged with coordinating the information and concept supplied from other disciplines. This need for breadth requires considerable flexibility in the arrangement of degree programs.

Water resources engineers draw principles from hydrology, fluid mechanics, hydraulics, environmental engineering, economics, ecology, political science, and other disciplines in the design and operation of projects and nonstructural methods for water resources planning and management. They need a sound understanding of how water storage, delivery, and other management systems function; of criteria used in evaluating and selecting among alternatives; of the techniques of operations research that can be used in system design; and of the institutional aspects of decision making in the public sector.

In addition to taking core courses in the water resources engineering academic program, students are encouraged to take courses in groundwater, fluid mechanics and hydraulics, environmental engineering, and hydrology for a background in the basic principles used in water resources management. Graduate students can supplement these departmental offerings by working with their supervisory committees in choosing courses in Mathematics and Statistics; Economics; Political Science; Geology; Biological and Irrigation Engineering; Plants, Soils, and Biometeorology; Sociology; Forest Resources; Rangeland Resources; Fisheries and Wildlife; and other departments.

The program combines training, research, and experience to cope with impending needs for water resources management in the United States. The department has one of the largest international water resources programs in the U.S., involving several technical assistance and training projects in Asia and Africa.

**Environmental Engineering.** The Division of Environmental Engineering is a multidisciplinary graduate program in the College of Engineering and is intended to enable engineers and scientists interested in the environment to obtain graduate degrees relating to potable water and waste treatment, toxic and hazardous wastes management, air quality management, natural systems engineering, and environmental impact assessment. The program provides an interdisciplinary educational approach to fundamental principles that can be applied to environmental phenomena. Research and training projects are a part of the program and provide the student with appropriate research experience leading to a thesis or dissertation.

The hazardous waste management specialization has been developed within the broader scope of the environmental engineering program to provide an integrated approach for students with a BS in engineering or natural sciences to deal with the complex issues of toxic and hazardous waste. Aspects of toxic/hazardous waste management, including characterization, treatment, disposal, control, monitoring, and environmental impacts, are dealt with in this program.

**Bioprocess Engineering.** The bioprocess engineering program has been developed as a cooperative effort between the Division of Environmental Engineering and the Biological and Irrigation Engineering Department. This program provides students with specialized coursework and research experience in areas of bioreactor processing of environmental materials and engineering scale-up of biologically based environmental reactions. Areas of specialization include waste to energy, fermentation, composting, and industrial waste (agricultural and chemical) reuse, recycling, and technologies based on biological processes, as well as engineering optimization of aquatic habitats.

**Transportation Engineering** is a growth area for graduate education and research. Expanding opportunities exist in many specialties of transportation engineering, including highways, transportation planning, traffic operations and safety, and mass transit.

Goals for the program are to provide educational and research opportunities to promising students in both traditional (fundamental) and advanced-technology transportation engineering. A multidisciplinary and multimodal approach serves to strengthen the students' abilities to understand and address future transportation needs. Emphasis on computer applications and technology integration produces highly skilled and well-rounded transportation professionals.

The Transportation Division offers a wide spectrum of courses to prepare students for "real life" challenges. These include: Airport Systems, Transportation Systems Analysis, Pavement Management, and Infrastructure Planning. Safety issues and the role of Intelligent Vehicle/Highway Systems (IVHS) technology in improving rural transportation safety and efficiency are an integral part of the research program of the Transportation Division. Traffic network simulation models, Geographic Information Systems (GIS), expert systems software, and other computer applications are used extensively in their research studies.
Financial Assistance

Both departmental and formal grant support are available to graduate students and are awarded on a competitive basis. Students requesting financial support should apply to the department by March 15 for the coming academic year.

A number of fellowships are available through the University and the department. Teaching assistantships are available through the department and research assistantships are available through the Utah Water Research Laboratory and department faculty members who have ongoing projects or who hold special research grants from the University, private companies, or state and federal agencies.

Acceptance to pursue graduate studies in the Civil and Environmental Engineering Department does not guarantee the student financial assistance. Inasmuch as funds are limited, the assistantships are awarded by the department to cover specific teaching assignments and by the faculty members to provide for research as funds are available.

Civil and Environmental Engineering Courses

504. Structural Matrix Analysis. Matrix procedures for statically determinate and indeterminate trusses, beams, and frames; energy theorems; stiffness and flexibility methods; computer applications. Prerequisite: CEE 306. (4F)

505. Design of Concrete Structures. Reinforced and prestressed concrete structures, analysis and design, building bridges. Prerequisite: CEE 308. (3F)

506. Design of Masonry and Wood Structures. Design of masonry and timber/wood structures. One-half quarter on each topic. Prerequisite: CEE 308. (3W)

507. Design of Steel Structures. Buildings, bridges, framework design. Design project. Prerequisite: CEE 308. (3W)

532. Foundations Analysis and Design. Engineering properties of soil and their effect on the design of footings, pile foundations, cofferdams, caissons, mat foundations, and retaining walls. (3Sp)

543. Groundwater Engineering. Analytical techniques for evaluating groundwater flow, quality, and yield. Aquifer properties, storage, movement, recharge, and withdrawal. Prerequisite: CEE 343. (3F)

549 (649). Small Watershed Hydrology. A detailed exploration of the concepts of small watershed hydrology. Coarse material will concentrate on recent research findings for examining key hydrological processes. (3Sp)

579. Accident and Emergency Management. Causes and impacts of accidental spills, fires, and explosions. Evaluation of safety/management practices and design considerations that can reduce potential accidents and their imprints. (3F)

580. Bioprocesses in Engineered and Environmental Systems. Applications of microbial metabolism, physiology, and ecology to degradation of waste materials in engineered systems and the environment. Prerequisites: MEB 111 and 112, or Biol 125. (4F)

581. Biochemical Engineering. Fundamentals of bioreactor design and bioengineering: Emphasis is placed on microbial systems for pollution control. Prerequisites: MEB 111 and 112, or Biol 125, and BIE/CEE 367. (3W)

582. Biomass Processing. Introduction to the use of renewable resources for energy production and waste management. Prerequisites: MEB 111 and 112, or Biol 125, BIE/CEE 367. (3Sp)

583. Land Treatment of Wastes. Engineering management of the upper part of the vadose zone for treatment and ultimate disposal of nonhazardous wastes, including industrial, agricultural, and domestic wastes. Prerequisites: CEE 364 and 543. (3W)

584. Agricultural Waste Management Systems. Evaluation and design of engineering treatment systems for the management of agricultural wastes, utilization of aerobic and anaerobic systems, ponds and land application facilities for agricultural waste management and control. Prerequisites: CEE 350, 351, and BIE/CEE 367. (3Sp)

585. Water Quality Modeling. The theory and application of computer models for evaluating the water quality of rivers and impoundments. Prerequisite: BIE/CEE 367. (3Sp)

588. Civil and Environmental Engineering Design Project. Major design experience that builds upon the fundamental concepts of basic sciences, engineering sciences, engineering design, and communication skills. (4W)

590. Cooperative Practice. A planned work experience in industry. Detailed program must have prior approval. Written report is required. (3-9)

MAE 602. Mechanical Vibrations. See MAE 602. (3)

603 (d512). Finite Element Methods in Civil Engineering. Introduction to finite element analysis, covering applications in solid and fluid mechanics using variational and Galerkin techniques; linear, quadratic elements, natural coordinates; computer implementation. Prerequisite: CEE 305. (3W)

MAE 604. Continuum Mechanics. See MAE 604. (3)

MAE 605. Elastic Theory. See MAE 605. (3)

606. Limit Analysis of Structures. Limit concepts applied to analysis of frame and plate structures; collapse loads, deflections, connections, secondary effects. (3F)


609. Similitude. Principles are developed and used to design research projects dealing with physical phenomena in solid and fluid mechanics. Prerequisite: instructor’s consent. (3)

610 (d508). Numerical Methods in Elasticity. Elasticity theory; stress and strain analysis; failure theories; yield criteria; flex and torsion theories for solids and thin-walled members; energy methods; introduction to numerical methods; computer implementations. Prerequisite: CEE 305. (3F)

613 (d513). Structural Dynamics (Earthquake). Analytical and engineering methods of evaluating the response of structural systems to earthquake-induced motion. Current and anticipated building code requirements. (3F)

614. Structural Optimization. Introduction to optimization techniques for linear and nonlinear, unvariable, and multivariable functions with or without constraints. Prerequisite: instructor’s consent. (3Sp)

615. Structural Reliability. Elements of probability theory and its application to structural engineering; statistical distribution of load; uncertainties in material parameters and their effect in design; reliability based safety analysis. Prerequisite: instructor’s consent. (3F,3Sp)

616. Experimental Methods in Structural Engineering. Experimental techniques used in research and design in structural engineering; structural models; theory and practical applications; development of principles used to design research projects. Prerequisite: instructor’s consent. (3W)

618 (d518). Mechanics of Composite Structures. Behavior of composite structures, including structural applications, manufacturing methods, joining and fastening, macro mechanical behavior, and analysis using computer techniques. Prerequisite: CEE 305. (3W)

619 (d519). Geographic Information Systems for Civil Engineers. Introduction to GIS concepts addressing data structures, spatial entities, and queries. Topics include location referencing methods, data collection techniques, current applications, institutional and organizational issues. (3)

620. Pavement Design. Analysis and design of flexible and rigid pavements for highways and runways, including the design of overlays. Prerequisite: CEE 621. (3W)

621. Transportation Systems Analysis. Focuses on the systems approach to transportation systems analysis, evaluation of alternatives, treatment of risk and uncertainty, system optimization, and resource allocation. (3Sp)
622 (d522). Traffic Engineering. Topics covered include characteristics, measurements, and analysis of volume, speed, density, and travel time; capacity and level of service analysis; signalization and traffic control devices. (3)

623 (d523). Geometric Design of Highways. Topics include survey techniques, principles of highway location, vehicle operating characteristics, horizontal and vertical alignment, intersection design, and the use of computers in geometric design. (3)

624 (d524). Transportation Planning. Urban and regional transportation planning process, data collection and analysis, travel demand modeling, land use, transportation interaction, computer applications. (3W)

625. Transportation Safety. Methodologies for analyzing transportation safety and designing countermeasures. Accident prediction models and evaluation of safety improvement projects. Prerequisite: CEE 321 or equivalent. (3F)

626. Urban Mass Transportation. Design and operation of transit systems in an urban environment. Demand, mode choice, routing and scheduling models, terminal location, and design considerations are explored. (3)

627. Traffic Flow Theory. Traffic flow characteristics, analytical techniques, queueing and traffic stream modeling, capacity and level of service analysis. (3F)

630. Earth and Rock Fill Dams. Design details of earth and rock fill dams, seepage, and stability analysis. Prerequisite: CEE 431. (3W)

631. Environmental Geotechnics. Geotechnical aspects related to various environmental systems such as waste containment facilities. Particular attention will be paid to the design of lines and covers for hazardous waste containment. Prerequisite: CEE 431. (3Sp)

632. Deep Foundations. Analysis and design of pile and drilled pier foundations. Prerequisite: CEE 532. (3Su)

633. Consolidation Theory and Soil Improvement. Consolidation theory including closed form and numerical solutions, settlement analysis and soil improvement. Prerequisite: CEE 431. (3Sp)

634. Soil Mechanics Laboratory. Subsurface investigations, field testing and instrumentation, geotechnical engineering reports. Prerequisite: CEE 431. (3Sp)

635. Retaining Structures. Analysis and design of retaining walls, anchored bulkheads, cellular cofferdams, excavations, and mechanically stabilized earthwalls. Prerequisite: CEE 431. (3W)

636. Soil Mechanics Laboratory. Subsurface investigations, field testing and instrumentation, geotechnical engineering reports. Prerequisite: CEE 431. (3Sp)

637. Buried Structures. Dimensional analysis and similitude considerations, soil characteristics, structure characteristics, buried cylinders, minimum soil cover, parallel trenches, pipe floatation, thrust restraints, backfilling, and tunnels. Prerequisite: CEE 431. (3F)

638 (d538). Earthquake Engineering—Geotechnical. Vibration theory, wave propagation, characteristics of earthquakes, influence of soils on ground shaking, prediction of ground motion, liquefaction, stability of dams, lateral soil pressure. Prerequisite: CEE 431. (3Sp)

640. Physical Hydrology. Elements of the hydrologic cycle and geomorphology. Prerequisites: CEE 343 and computer programming or instructor's consent. (4F)

641. Surface Runoff Hydrology. Generation of surface runoff from precipitation and routing of flow through reservoirs and channels. Prerequisite: CEE 460. (3W)

642. Engineering Risk and Reliability. Static and dynamic risk and reliability analysis. Frequencies of extreme events. Queuing and availability models. Bayesian decision theory. Hydrologic and engineering applications. Prerequisite: Undergraduate probability and statistics. (3F)


**644. Groundwater Problem Solving.** Solving practical groundwater flow and contamination problems using a variety of methods. Focus on problem formulation and solution method choice. Prerequisites: CEE 643 and 648. (3F)

645. Hydroclimatolgy. Representation of hydrologic processes with parametric models. Scale issues, model formulation, validation, and calibration. Example applications of Stanford and Hydrologic Engineering Center models. Prerequisite: CEE 641. (3Sp)

646. Hydrologic Time Series Analysis. Markov processes, linear, nonlinear, and nonparametric time series models. Spectral analysis. streamflow, rainfall, groundwater and lake applications. Prerequisite: CEE 642. (3W)

647. Groundwater Modeling. Numerical techniques for groundwater flow and contamination modeling. Includes FEM, FDM, BEM, and MOC. Prerequisites: CEE 643 and 648. (3Sp)

648. Subsurface Contaminant Transport. Quantitative analysis of contaminant transport in subsurface, including groundwater, vapor, and separate phase. Prerequisite: CEE 643. (3W)

650 (f753). Numerical Methods in Engineering. Finite differences and other numerical techniques for solving analysis and design problems. Methods adapted to digital computers are stressed. Prerequisite: instructor's consent. (3W)

653. Steady and Unsteady Hydraulic Modeling. Unsteady channel flows, numerical solutions of St. Venant equations, control of channel flows, automatic gates, hydraulic computer models—their applications and limitations—two-phase flow systems, scour and deposition application. Prerequisite: CEE 653. (3Sp)

655. Open Channel Flow. Theory and application of steady uniform and varied flow under both subcritical and supercritical flow conditions. Unsteady flows which result in both positive and dispersive waves. Prerequisite: CEE 351. (4F)

656 (d556). Sedimentation Engineering. Sedimentation problems, transport mechanisms, measurement techniques, sources, yields, control methods, economic and legal aspects. Prerequisite: CEE 351. (3Sp)


658. Fluid Mechanics. Nature of fluid state, coordinate systems, general equations of fluid motion with solutions and applications; potential flow; boundary layers, turbulence, convection, and dispersion; unsteady flow. Prerequisite: CEE 351. (4F)

660 (d561). Water Quality Analysis. Methods of physical, chemical, and biological analysis of water and wastewater; underlying principles and limitations of test methods; statistical significance of data. Two lectures, two labs. Prerequisites: Chem 122, 124. (4F)

661 (d570). Environmental Management and Regulation. Multimedia environmental quality management based primarily on current federal environmental regulations. (3F)

662 (d586). Air Quality Management. Classifications of air pollutants and their sources, air quality standards, atmospheric sampling and analysis, technical approaches to control, regulatory measures, and selected topics in meteorological and biological effects. Prerequisite: instructor's consent. (3)

663 (d578). Solid and Hazardous Waste Management. Nature and scope of the solid waste disposal problem, the general state of the art, and management solutions based on social, economic, and technical considerations. Prerequisite: instructor's consent. (3Sp)

664, 665, 666. Water and Wastewater Treatment. Advanced theory and design of physical, chemical, and biological unit operations and processes involved in water and wastewater treatment. Three lectures for 664; three lectures, one lab for 665 and 666. Prerequisite: instructor's consent. (3F) (1W) (4Sp)

667. Industrial Wastewaters. Theory, design, and application of environmental engineering principles for industrial wastewater treatment. Two lectures, one lab. Prerequisite: CEE 666. (3Sp)

668 (d568). Soil Based Hazardous Waste Management. Engineering management of hazardous wastes present in the vadose zone including extraction, containment, and destruction technologies. Aspects include engineering characterization, problem definition, treatment, and monitoring. Prerequisites: Chem 122, 124, CEE 363, 364. (3F)

669. Water Resources Engineering. Economic and multi-objective analyses of water projects and water resources development and management programs. Applications including various water use sectors at different scales and time frames. Prerequisites: CEE 343 and 351. (3)

672 (d562). Chemistry of Aquatic Systems. Emphasis on the chemical processes occurring in natural environments. Principles of physical
chemistry applied to problems involving the composition of natural waters and man's influence on these systems. Prerequisite: Chem 301. (3)

673 (d573). Analysis and Behavior of Environmental Contaminants. Techniques used to analyze organic compounds in environmental samples will be presented. Extraction concentration, clean-up, and instrumentation techniques will be emphasized. Modeling the environmental fate and behavior of these compounds will also be discussed. Prerequisites: Chem 122, 141. (3Sp)

674 (d574). Applied Fluid Mechanics. Hydraulic and economic design of piping and open channel systems, including transitions and controls. Introduction to gas dynamics, lift and drag, and potential fluid flow. Prerequisites: CEE 350, 351 and proficiency in a high-level computer programming language. (3F)

675 (d575). Hydraulic Design. Design and operation of pipelines, economic analysis, pipe material and pipe pressure classes, pump hydraulics and selection, flow control valves, cavitation analysis and design. Prerequisites: CEE 350, 351, 674/574. (3W)

676 (d576). Hydraulic Transients. Unsteady flow in closed conduits, transient analysis of water hammer caused by operating pipelines, valves, pumps, and turbines. Prerequisite: CEE 351 or MAE 355. (3Sp)

677 (f742). Water Resource Systems I. Structuring problems for optimization. Linear, integer, mixed integer, and dynamic programming applied to reservoir, multi-reservoir, and other water resources management problems. Prerequisites: CEE 343, 351, and 420. (3F)

**678 (f743). Water Resource Systems II. Nonlinear programming and stochastic optimization with applications to water resource problems. Pareto optimal solutions and nondominated sets. Pitfalls in systems analysis. Prerequisite: CEE 677. (3Sp)

679. Water Resource Systems III. Integrated regional approach to planning water resources development through reconnaissance, design, implementation, and operation. Use of basin models and geographic information systems. Prerequisite: CEE 677. (3W)

680. Graduate Seminar. (1F, W, Sp) **

687 (d587). Hazardous Waste Incineration. Introduction to thermal treatment of hazardous wastes through study and application of thermochcmical principles for high temperature combustion of liquid and solid wastes. Prerequisites: Engr 330; CEE 350, 351. (3W)

690. Directed Reading. Prerequisite: instructor's consent. (1-3F, W, Sp, Su) **

693. Special Problems. Independent or group study of engineering problems not covered in regular course offerings. (1-4F, W, Sp, Su) **

695. Design Project. Individual projects involving the design, development, and/or testing of components, devices, or systems. A formal report is required. (3F, W, Sp, Su)

696 (d596). Management of Regulated Rivers. Applications of existing multidisciplinary assessment methods for physical, chemical, and biological elements affected by water resource systems are applied, with an emphasis on integration of component studies for decision making. Prerequisite: CEE 351, 369, or permission of instructor. (3Sp)

697. Thesis Research. (1-9) **

699. Continuing Graduate Advisement. (1-12F, W, Sp, Su) **

MAE 702. Mechanical Vibrations. See MAE 702. (3)

MAE 705. Elastic Theory. See MAE 705. (3)

708. Plate and Shell Theory. Analysis of plates and shells of complex configurations by classical and numerical methods. Prerequisite: CEE 693. (3W)

709. Numerical Analysis of Plates and Shells. Analysis of cylindrical shells, shells of revolution, and shells of complex curvature by classical and numerical methods. Prerequisite: CEE 708. (3Sp)


712. Advanced Topics in Civil Engineering. Current research topics conducted by the civil engineering faculty and staff at USU and elsewhere. Prerequisite: instructor's consent. (3Sp)

720. Airport Systems Planning. Aviation demand forecasting, air terminal and ground access systems evaluation, environmental impact assessment, and airfield/airport traffic control. (3W)

**741. Stochastic Subsurface Hydrology. Analysis of the impact of heterogeneous subsurface structure on transport and flow problems. Prerequisites: CEE 643 and 949. (3W)

744. Analysis of Water Resources Institutions. Application of institutional concepts in civil engineering planning. Seminars address agency hierarchies, mission and regulatory roles, public participation, property and water rights, equity, and other issues. (3Sp)

745. Applied Engineering Microeconomics. Numerical and graphical applications of microeconomic analysis to optimize water project design and operation. Impacts on income distribution and economic stability. Simulation models and financial analysis. Prerequisite: CEE 420. (3F)

746. Advanced Topics in Hydrology. Topics of prominent current interest. (3F)

747. Water Resources Planning. Joining structural and nonstructural measures in the design and operation of projects for supply, flood control, water quality control, recreation, and power generation, considering instream flows. Prerequisites: CEE 343 and 420. (3F)

752. Porous Media Flow. Steady and unsteady flows through saturated and unsaturated porous materials, solved analytically as well as numerically. Prerequisites: CEE 350 or equivalent; CEE 603. (3Sp)

754 (f654). Spatial Hydrologic Analysis. Estimation of hydrologic fields in space and time. Regionalized variables, kriging, nonparametric geostatistics. Sampling network design, areal estimates, rainfall, and groundwater. Prerequisite: CEE 646. (3Sp)

*758. Advanced Finite Element Analysis. Application of the finite element method of analysis to problems in fluid mechanics. Prerequisites: CEE 512, 601, or MAE 501. (3Sp)

759 (f595). Inverse Problems and Hydrologic Model Identification. Concepts of statistical estimation, filters, identifiability and stability, regularization and solution methods, groundwater and surface runoff model calibration. Prerequisites: CEE 641, 643, 646, and 678. (3Sp)

768. Applied Natural Systems Modeling. Explores engineering applications of state-of-the-art models utilized to assess impacts on natural systems. (3W)


**799. Continuing Graduate Advisement. (1-12F, W, Sp, Su) **

(Repeatably for credit. Check with major department for limitations on number of credits that can be counted for graduation)

Parenthetical numbers preceded by * indicate a dual listing; parenthetical numbers preceded by an † are the former course numbers.

*Taught 1995-96.

†Taught 1996-97.
Department of
Communication
College of Humanities, Arts and Social Sciences

Head: Professor Edward C. Pease, media criticism and research
Office in Animal Science 310B, 797-3293

Graduate Program Coordinator: Associate Professor James O. Derry, media management

Professors Emeritus Burrell P. Hansen, radio production; Nelson B. Wadsworth, photojournalism and news/editorial;
Adjunct Professor Alan M. Hofmeister, distance education; Associate Professors Penny M. Byrne, television production; Scott A. Chisholm, media management; Donald T. Cundy, media research; Adjunct Associate Professors R. Brent Ballow, media law; Lee Roderick, print/broadcast journalism; L. Michael Zinsen, media law; Associate Professor Emeritus Gerald L. Allen, radio production; Assistant Professors Brenda Cooper, gender criticism and research; Nancy M. Williams, news/editorial; Adjunct Assistant Professor Andrew Giarelli, print journalism

Degrees offered: Master of Arts (MA), Master of Science (MS)

Specializations: Media Management; Print, Photo, and Broadcast Journalism

Admission Requirements

See general admission requirements on pages 25-26. In addition, a portfolio of recent work, including clippings, photographs, audio tapes or video tapes, as appropriate, is required. Before matriculation, basic requirements not acquired through prior courses or experience must be completed. These credits will not be counted toward the graduate degree. Suggested prerequisite courses for radio/television students include: Comm 283, 370, 387, and 484; for print students: Comm 210, 321, and 420. Other nongraduate courses may be required.

Specializations

The graduate program is designed to improve skills within a family of journalism-related fields. Students are encouraged to develop a plan of study within print, photo, and broadcast journalism or media management. In print and photojournalism, students have an opportunity to work with the Cache Citizen, a commercially-operated weekly serving 14,000 residents of Cache Valley; broadcast students can work with KUSU-FM, with USU's Multimedia and Distance Learning Services, and/or with department cablecast programs; management students can work with the Cache Citizen, when appropriate, or with any of the media outlets mentioned above.

Students can either specialize or follow a general plan of study appropriate to public relations and organizational communications.

Core Courses

Core courses for the master's degree are Comm 601 and 670, plus courses in survey research, qualitative methods, and theory. Students are required to submit a detailed plan of study within the first five months of graduate study.

Students may elect either Plan A (thesis) or Plan B (non-thesis) options to fulfill the degree requirements. Plan A is advised for students planning to continue graduate study, to teach, or to enter professions requiring research skills. Plan B may be elected by students seeking a terminal, professionally oriented degree. Selection of the Plan A or Plan B option must be made in consultation with the adviser.

Of the minimum of 45 credits required for graduation, Plan A students may use a maximum of 9 credits for thesis and Plan B students may use a maximum of 3 credits for the Plan B project, plus 3 credits of approved internship. Between 6 and 15 graduate credits must be taken in a cognate area.

Financial Assistance

Departmental support is available to graduate students on a competitive basis. Students requesting financial support should apply to the department by February 15.

Communication Courses

500. Projects in Communication. Individualized readings and projects. Prerequisite: consent of student's adviser. Maximum of 6 credits may be counted toward a degree. (1-5F,W,Sp,Su) 

502. Communication Ethics. Ethical theory and practice in interpersonal, group, organizational, and mass communication. (3Sp)


504. School Publications. Problems of advising staffs of school newspapers, yearbooks, and magazines. (3Su)

506. Advanced Photojournalism. Laboratory work in use of cameras to communicate news and to make social statements. Prerequisites: Comm 130 and 206. (3W)

510. Advanced Editing Practicum. Senior editorial staff providing editorial content for a weekly community newspaper. Prerequisite: only by permission of instructor. Repeatable to maximum of 4 credits. (1F,W,Sp,Su)

513. Mass Media Law. Principles of the law of libel, privacy, copyright, press freedom, and responsibility as they apply to the news media. (3F)

530. Magazine Article Writing. Lectures and practice in preparing feature articles for magazines. Analysis of periodical markets. Prerequisite: Comm 210 or permission of instructor. (3F)

531. In-depth Reporting. Researching and reporting public affairs in depth. Prerequisite: Comm 210. (2Sp)

565. Mass Communication Theory. Intensive study of major theories and issues, using models and research techniques. Application of these theories to significant societal problems. (3Sp)
580. Mass Media Management. Examines the methods, techniques, and principles of managing the media organization, including newspapers and broadcast stations. (3F)

582. International Communications. Study of mass communications within and between countries. Systems and techniques of mass communication. Possibilities of bringing about better understanding between countries and cultures. (3W)

583. Advanced Television Production. Projects to develop the imagination, creativity, and aesthetic judgment for different types of television programs, and to develop and perfect skill in television production. Prerequisite: Comm 370. (3Sp)

587. Educational Television and Radio. Production of radio and television materials for education uses; methods for effective classroom utilization of audio and visual materials and programs. (3W, Su)

601. Introduction to Mass Communication Graduate Study. A combination diagnostic and planning course that presents the student with a series of basic print, broadcast, and media management assignments. (2F, W, Sp, Su)

602. Seminar in Community Journalism. Explores processes and problems of news reporting. To be taken concurrently with coursework or assistantship assignment related to laboratory media outlets. Repeatable to a total of 3 credits. (1F, V, Sp, Su)®

610. Communication Theory and Technology for International Agricultural Extension. Use of communication theory and technology by extension field workers in less developed countries. (3Sp)

611. Internship. Supervised in-service training. Limited to graduate students. Registration only with instructor's permission and placement in an internship. (1-6F, W, Sp, Su)®

617 (d417). Persuasion, Political Campaigns, and the Mass Media. Examines the role played by the mass media in American political campaigns with particular emphasis on paid political advertising. (3F)

620. Feature Article. An intensive newspaper feature writing course, presenting students with profile, sidebar, social services, education, and service feature assignments. (3W)

625. History of Communication. In-depth focus on an aspect of communication's history chosen from ancient Greece to present. (3Sp)

630. Reporting on Arts and Culture. Techniques and principles relating to writing for print and/or producing broadcast materials about artistic and cultural events and activities. Includes writing critical reviews. (3W)

635. News Analysis, Commentary, and Editorials. Writing analysis, commentary, and opinion with emphasis on major regional and national issues. (3F)


650. Regional Issues. Reporting on Intermountain West issues, including environment, federal-state conflicts, Native Americans, and economic concerns. Emphasis on finding and using appropriate news sources. (3F)

670. Introduction to Research. Introduction to the major research techniques used in the field of communication. Involves research design and methods of data generation. (4W)

680. Research Seminar. Special topic seminar focusing on research problems and methodology. Repeatable to 6 credits. (3Sp)®

683. Television Direction. Seminar/lab. Students produce and direct both studio and field productions. Aesthetics and technical concepts of production included. (3Sp)

685. Problems in Media Practice. Researching problems and issues in community journalism, broadcasting, and other media. Repeatable to 6 credits. (3F, W, Sp, Su)®

687. Legal Issues in Mass Media. Regulation and control of mass media. (3W)

690. Research Studies. Advanced research in communication. (1-5)®

697. Thesis. (1-9)®

699. Continuing Graduate Advisement. (1-3)®

Department of
Communicative Disorders and Deaf Education

College of Education

Head: Professor Thomas S. Johnson, speech-language pathology
Office in Communicative Disorders 102A, 797-1381

Professors James C. Blair, educational audiology and director of the program in education of the deaf and hard of hearing; Steven H. Vieheag, clinical audiology; Professors Emeritus Frederick S. Berg, educational audiology; Thomas C. Clark, educational audiology and education of the deaf and hard of hearing; Joy R. Jensen, speech-language pathology; Associate Professors N. Brandt Culpepper, clinical audiology; Beth E. Foley, speech-language pathology; Jess Freeman King, education of the deaf and hard of hearing; Sonia S. Manuel-Dupont, speech-language pathology; Carol J. Strong, speech-language pathology; Assistant Professors L. Jaclyn Litteldeke, speech-language pathology; Clinical Assistant Professors Peggy G. Benson, clinical audiology; Kim Corbin Lewis, speech-language pathology; Susan Watkins, educational audiology; Clinical Instructors Dee R. Child, speech-language pathology, Anne Elseweiler, speech-language pathology; Janet K. Jensen, speech-language pathology; Jan Kelly-King, education of the deaf and hard of hearing; Ann B. McKechnan, speech-language pathology; Elizabeth Parker, education of the deaf and hard of hearing; Sheryl Y. Spriet, clinical audiology
Admission Requirements

Students must meet the minimum requirements specified by the School of Graduate Studies (see pages 25-26). Additionally, all students seeking a degree in speech-language pathology, education of the deaf and hard of hearing, or clinical and educational audiology must have an undergraduate degree from an accredited college or university. For those students coming from other academic disciplines, the undergraduate major requirements for the BS degree must be met before matriculation in the graduate program.

Students seeking the MEd in education of the deaf and hard of hearing must have an undergraduate degree in either early childhood education or elementary education with a minor emphasis in communicative disorders. For those coming from other academic disciplines, the minor requirements must be filled in addition to the regular MEd program.

Applications will be considered once a year between April 1 and April 15. However, students must have completed the application process to the School of Graduate Studies by February 15. No application will be considered until all the required information is submitted to the School of Graduate Studies.

Master's Degrees

Generally, all students will complete the requirements as specified below. In some instances students will have had some of the coursework required in the graduate curriculum as part of the undergraduate training at another institution. In those cases the program will be individualized to meet national certification through the American Speech-Language-Hearing Association (ASHA) and state educational certification and licensure from the State of Utah. In no instance will students amass fewer than 54 graduate credits.

At the end of their programs all graduate students, except for those in education of the deaf and hard of hearing, must take the NTE examination in their area of specialty. Students are required to list USU as a recipient of test scores. Candidates must verify in writing that they have registered for the exam and that they have listed USU as a recipient before a letter of completion will be sent to the School of Graduate Studies.

Speech-Language Pathology. The program in speech-language pathology is accredited by the Educational Standards Board of the American Speech-Language-Hearing Association (ASHA). The Utah State Office of Education has also approved the program. Students completing the master's curriculum are eligible for certification from ASHA and the State of Utah Board of Education and additionally have met the academic and practicum requirements for licensure from the State of Utah. As a consequence of preparation and certification or licensure, students are prepared for employment in any setting where the services of a qualified provider of speech and language services are provided. The following courses are required of all students seeking the MS degree in speech-language pathology: Com D 611, 621, 622, 628, 631, 640, 641, 675, 681, 684, 685 (students must take four different 685 seminars), 689, 697. Students must also be registered for clinical practicum (Com D 640, 641, or 651) each quarter in their curriculum.

Clinical and Educational Audiology. The program in clinical and educational audiology is accredited by the Educational Standards Board of the American Speech-Language-Hearing Association (ASHA) and is also approved by the Utah State Office of Education. Students completing the master's curriculum are eligible for certification from ASHA and the State of Utah Board of Education and additionally have met the requirements for licensure from the State of Utah. As a consequence of preparation and certification or licensure, students are prepared for employment in any setting where the services of a qualified provider of audiological services are provided. The following courses are required of all students seeking the MS degree in clinical and educational audiology: Com D 500, 583, 608, 620, 624, 628, 639, 644, 658, 668, 675, 679, 680, 685, 687, 688, 692, 693, 697, and 698. Students must also be registered for clinical practicum (Com D 608, 644, or 698) each quarter in their curriculum.

Education of the Deaf and Hard of Hearing. The program in Education of the Deaf and Hard of Hearing is accredited by the Council on Education of the Deaf (CED) and is also approved by the Utah State Office of Education. Students completing this program are certifiable by the Utah State Board of Education as teachers of the deaf and hard of hearing and they also meet the requirements for certification by CED. Students who complete the curriculum are prepared to provide services as teachers of the deaf and hard of hearing in any setting in which such services are provided. The following courses are required of all students seeking the MEd in education of the deaf and hard of hearing: Com D 554, 556, 601, 602, 606, 613, 615, 626, 627, 638, 639, 647, 650, 653, 654, 655, 657, 659, 672, 673, 685, and 696.

Educational Specialist Degree

The department offers an Educational Specialist (EdS) program that can be individualized to suit a candidate's need within a basic structure of educational audiology and with a focus on research, supervision, and evaluation. The program is designed for those individuals who have completed the master's degree and who are practicing in educational settings. The degree requires a minimum of 45 credits beyond the master's degree and may be completed in two summers of coursework on campus and four quarters of extension study and research in conjunction with the individual's workplace.

Research Requirements

Several options are available to graduate students to complete the research or special project required for the MS or MEd. These options are specified in the list of requirements available in the department office and include the traditional Plan A experimental thesis option,
the Plan B integrative review option or creative project option, the Plan C additional coursework option, and the MEd creative project option. Declaration of an option must be made at the time the student files an Application for Candidacy form with the graduate school. Changes in the option will necessitate a complete revision and review of the Application for Candidacy by the student’s supervisory committee.

Practicum Opportunities

Practicum experience at the graduate level is available in a variety of settings. The department maintains a Speech-Language-Hearing Center offering a full range of diagnostic and remedial services to individuals with speech-language or hearing disabilities. Additionally, students are assigned to off-campus practicum sites such as hospitals, schools for the deaf, convalescent centers, clinics, physician’s offices, and public schools. Placement in out-of-state practicum sites is available for those students who request it. Students may also be placed at the Center for Persons with Disabilities for experience in a multidisciplinary, severely handicapped setting. **Students must be enrolled in clinical practicum each quarter of their graduate program.**

Financial Assistance

Limited departmental and federal grant support are available to graduate students and are awarded on a competitive basis. The application form for financial support is available from the department and must be returned to the department no later than March 1 for consideration for the coming year.

Communicative Disorders and Deaf Education Courses

500. Institute in Communicative Disorders. Special colloquial offerings in communicative disorders. (1-5F,W,Sp,Su)

507. Speech Science I. Contemporary theory, research findings, clinical applications, and laboratory experiences in measurement and analysis of speech production. (3Sp)


542. Internship in Audiology. Supervised diagnostic and remedial practicum with auditorily impaired individuals. Prerequisite: consent of instructor. (1-5F,W,Sp,Su) 540

554. Introduction to Education of the Deaf and Hard of Hearing. Provides students entering the teacher preparation program for the deaf and hard of hearing with an overview and philosophical underpinning of teaching the deaf and hard of hearing. (3F)

556. Sign Language III. Specialized signs used in academic settings will be taught. Methods for using all systems (signs, speech, audition) simultaneously will be presented. (3F,W,Sp)

560. Aural Rehabilitation for Children. Introduction to the principles and techniques of aural rehabilitation, specifically related to intervention with preschool and school-aged children with hearing loss. (3W)

581. Introduction to Immittance Audiometry. Provides understanding of theory and application of immittance audiometry and develops skill in administration and interpretation of results. (2P)

590. Independent Study. Selected work individually assigned, handled, and directed. Problems of mutual interest to students and the instructor are investigated and reported. (1-8F,W,Sp,Su) 556

601. Audiology and Teachers of the Deaf and Hard of Hearing. Focuses on the field of audiology and how information from this discipline relates to the education of deaf and hard of hearing children. (4F)

602. Socio-Cultural Aspects of Deafness. Introduces students to deaf culture. (3F)

604. (d408). Listening Problems in the Classroom. Hearing, speech, and listening considerations; room acoustics, hearing aids, FM equipment. For elementary, secondary, and special education educators. (1-4F, W,Sp)

606. Anatomy/Speech and Hearing for Teachers of the Deaf. Basic anatomy and physiology of the ear, auditory nerve, and hearing centers of the brain. Information on how hearing works and how speech is processed. (3F)

607. Speech Science II. Considers the theoretical and clinical applications of instrumental assessment of speech and voice production. Focuses on disordered speech and voice signal. Clinical assessment and management addressed. Prerequisite: Com D 507. (1W)

608. (d508). Internship in Audiology. Supervised diagnostic and remedial casework in audiology. Prerequisite: consent of instructor. Must be accepted into Teacher Education prior to enrollment. (1-4F, W,Sp,Su) 542

609. (d510). Grammatical Analysis of Language Disability. This course provides basic information in the clinical analysis of syntactic and morphological properties of productive language disorders. (5F)

610. Neurological Bases of Speech and Language. Study of neuroanatomy and neurophysiology underlying speech production. (2)

611. Neuropathologies of Speech. Study of neurologically-based speech and language disorders, including cerebral palsy, aphasia, right-hemisphere dysfunction, and traumatic brain injury. (4F)

613. Speech for the Deaf and Hard of Hearing. Evaluative and instructional models, processes, and methodologies in the developmental speech management of deaf and hard of hearing children. (3W)

615. Strategies for Teaching Speech to the Deaf and Hard of Hearing. Practical methods for applying theories of speech teaching to classrooms with deaf and hard of hearing children. (3F)

616. Family Interaction and Involvement with Handicapped Children. An examination of the impact of a handicapped child on the family. Course will provide students with knowledge and skills to work effectively with families. (3F,W,Sp,Su)

617. Implementation in Home Based Programs for Handicapped Children. Students will learn to implement a home based program, including planning, selection of materials, implementing the plans, and evaluating the effectiveness of services. (3F,W,Sp,Su)

618. SKI*HI Basic Training. Basic training in early home intervention following the SKI*HI Model of delivery. Readings, video, and interaction concerning home intervention with children who have hearing losses and their families. (3)

619. INSITE Basic Training. Students will learn to implement a home-based program for parents of children having one sensory disability and one or more other disabling conditions (INSITE). (3F, W,Sp,Su)

620. Rehabilitative Audiology. Ramifications of hearing loss among adolescents and adults and rehabilitative audiological technologies and programs. (3Su)


622. (f521). Communicative Disorders Management in the Public Schools. Considers the special requirements related to delivery of services in communicative disorders in the schools. Presents program organization, delivery models, management, federal and state requirements. Prerequisites: Com D 312, 549, 551. (3F)

624. Special Auditory Tests. Advanced theory and practice of audiological evaluation. Prerequisite: Com D 398. (5W)

626. Teaching Language to the Deaf and Hard of Hearing. Evaluation and teaching of language to deaf and hard of hearing children—written pictures story test—language development and remediation using structure, modeling, natural approach, and grammar. Prerequisite: Com D 270. (3F)

628 (D528). Educational Audiology. Management of deaf and hard of hearing children in the regular schools; population and individual profiles; evaluation and staffing; models of delivery; integration considerations; remedial and facilitative programming. (SW)

631. Disorders of Fluency—Stuttering. Theoretical, clinical, and experimental approaches to stuttering and other disorders of speech rhythm. (FP)

637. Sign Language IV. Amalgamation and synthesis of three previous sign language classes. How to properly present information to deaf students based on their unique communication needs. (3W)

638. Programming for the Young Deaf and Hard of Hearing Child. Management of the infant and young hearing-impaired child. Identification, testing, hearing aids, home language and auditory management, parent programs, child development. (4W)

639. Educational Audiological Evaluation and Referral. Selection and administration of appropriate educational audiological tests for individuals who have hearing loss. Also scoring tests, making recommendations, and seeking additional information through referral to other professionals. (3Sp)

640 (F541). Internship in Speech Pathology. Supervised diagnostic and remedial casework with speech handicapped individuals. Prerequisites: consent of instructor and admission to teacher education. (1-5F, W, Sp, Su)

641. Public School Internship in Speech Pathology. Supervised diagnostic, remedial, and educational internship appropriate to the area of specialization. Prerequisite: consent of instructor. (1-4F, W, Sp)

642. Diseases of the Ear. Students will learn about various diseases of the ear and their effect on hearing and learning. (3W)

643. Dysphagia in the Pediatric and Adult Populations. Addresses the anatomical structures and physiological processes of the normal and abnormal swallow in the pediatric and adult populations. Clinical evaluation and management is considered in detail. (2Sa)

644. Public School Internship in Audiology. Supervised public school practicum in audiology. Prerequisite: consent of instructor. (1-12F, W, Sp)

645. Early Intervention for Infants and Toddlers With Vision Impairment and Their Families. Students will gain an understanding of and develop skills in working with infants and toddlers who are visually impaired and their families. (4F, W, Sp)

646. Serving Preschoolers with Vision Impairments in Center Based Settings. To provide students with knowledge and skills in working with children with visual impairments in the preschool setting. (4F, W, Sp)

647. Sign Language V. Basic concepts of linguistics pertaining to ASL structure. For students who know how to sign ASL. Prerequisite: Com D 637. (3Sp)

649 (D549). Evaluation of Language Disorders. Evaluation of the language and communication skills of prelinguistic, preschool, and school-age children, using formal and informal assessment procedures. Prerequisites: Com D 270, 510, or equivalents. (FP)

650. Teaching Reading to the Deaf and Hard of Hearing Children. Methods used to teach reading to the deaf and hard of hearing. Current research regarding the effectiveness of methods that can be used. (3W)

651. Internship in Speech Pathology. Supervised off-campus externship in speech pathology. Prerequisite: consent of instructor. (1-12F, W, Sp, Su)

652 (D551). Remediation of Language Disorders. Language therapy for semantic, syntactic, and pragmatic aspects of language in infants and preschool children. Includes theoretical approaches, as well as published materials, and emphasizes parental role in intervention. Prerequisite: Com D 649/549. (3W)


654. Deaf and Hard of Hearing Children With Multiple Disabilities. Students will obtain a basic understanding of the problems, characteristics, and rehabilitation of children who have hearing loss plus one or more handicapping conditions. (3F)

655. Curriculum Adaptations for Teachers of the Deaf and Hard of Hearing. Methods for adapting or modifying curriculum prepared for children with normal hearing to more appropriately meet the needs of the deaf and hard of hearing. (3F)

657. Mainstreaming the Deaf and Hard of Hearing. Rationale and procedures used to successfully mainstream children with hearing loss. Also methods of evaluating programs where children with hearing loss are to be placed. (3W)


659. Psychology and the Deaf and Hard of Hearing. Psychological theories and research used to describe the deaf and hard of hearing. Exploration of basic questions concerning these views. (3W)

668. Industrial Audiology. A study of the role of audiologists in the development and implementation of a hearing conservation plan for industry. (3W)

672. Internship in Education of the Deaf and Hard of Hearing. Supervised field-based internship in teaching deaf and hard of hearing youngsters in a variety of settings. (3-8F,W)

673. Student Teaching in Education of the Deaf and Hard of Hearing. Actual teaching experience in residential schools for the deaf to provide in-depth understanding of the total education program. (3-9W)

674. Associate Teaching in Hearing Impairment. Teaching experience with hearing-impaired children in home or mainstreamed settings. (3-9Sp)

675. Introduction to Research in Communicative Disorders. An introduction to research methodology, experimental design, issues, and interpretation. Statistical inference and educational significance are also considered. Prerequisite: prior to or concurrent Psychology (3)

678. Professional Practice. A lecture, discussion, field trip course intended to provide the student in audiology with a general awareness of opportunities in fee-for-service work milieu. (3Su)

679. Pediatric Audiology. A lecture, discussion, demonstration course designed to provide the advanced audiology student with a knowledge of audition in the normal and the hearing-impaired pediatric population. Prerequisite: Com D 398. (3Sp)

680. Advanced Hearing Science. A study of structure and function of the ear and an examination of psychoacoustics. Students must have taken Psychology (3) or its equivalent, prior to taking this course. (F)


684. Disorders of Motor Speech in Pediatric/Adult Populations. Considers the theoretical constructs underlying dysarthria and apraxia in the pediatric and adult populations. Methods of evaluation and management will be addressed. (4F)

685. Seminar in Communicative Disorders. (Audiology, Speech Pathology) Research and analysis of selected topics. (2F, W, Sp, Su)

687. Hearing Aids. Consideration given to hearing aid types, components, electroacoustic characteristics, determining patient candidacy, measuring patient performance, evaluation procedures and philosophies, and professional commercial relationships. Prerequisite: Com D 398. (3F)

688. Electrophysiological Auditory Tests. Designed to train students to administer and interpret electroencephalographic and evoked potentials auditory tests used in auditory site of lesion testing. (3Sp)

689. Assessment and Educational Services for the Bicultural/Bilingual/Bidialectal Child. Readings and discussion of the bicultural/bilingual/bidialectal English speaking child in order to obtain a clearer understanding of their special situations and needs. (3W)

690. Independent Study. (1-12F, W, Sp, Su)

691. Independent Research. (1-12F, W, Sp, Su)

692. Advanced Hearing Aids. Consideration given to real ear measurement and fitting of hearing aids, programmable hearing aids, and marketing techniques. Prerequisite: Com D 687. (3F)

693. Advanced Clinical Audiology. Course is designed to synthesize the area of clinical audiology. Students will be given opportunities to examine case studies of various clients and, based on the audiometric
Department of

Computer Science

College of Science

Head: Associate Professor Donald H. Cooley, fuzzy logic, genetic algorithms, neural networks, multimedia systems
Office in Main 414, 797-2451

Coordinator for Graduate Programs in Computer Science: Associate Professor Gregory W. Jones, computability, GUIs, software engineering

Professor Scott R. Cannon, parallel processing, real-time systems, biomedical applications; Professors Emeritus Rex L. Hurst, statistical computation, information systems; Wendell L. Pope, data structures, automatic software generation, programming languages; Associate Professors Stephen J. Allan, parallel processing, parallel programming, recognition of parallelism, program optimization; Vicki H. Allan, instruction-level parallelism, register allocation, software pipelining, program optimization; Heng-Da Cheng, image processing, artificial intelligence, parallel processing, computer vision, fuzzy logic, VLSI algorithms and architectures, neural networks; Nelson T. Dinerstein, analysis and construction of information systems, database management systems, applications of small computers; Darre N. Egbert, scientific computing, computer graphics; Assistant Professors Stephen W. Clyde, software engineering, object orientation, distributed systems, database theory, multimedia systems; Nicholas S. Flann, machine learning, artificial intelligence; Daniel W. Watson, parallel and heterogeneous computing, interconnection networks; Jianping Zhang, artificial intelligence, machine learning, intelligent computer-aided instruction.

Degree offered: Master of Science (MS)

Specializations: Artificial Intelligence, Computer Graphics, Information Systems, Parallel and Distributed Computation, Software Engineering

Computer science deals with the programming, use, management, and organization of computers. Students specialize in many different areas, several of which have strong ties to other disciplines such as mathematics, electrical engineering, statistics, accounting, and business administration.

Admission Requirements

Applicants should have a bachelor's degree in Computer Science or extensive experience with computing. Those whose quantitative score on the GRE general test is less than 640 must show compensating strengths in their backgrounds to be considered. Applicants must take the GRE subject exam in Computer Science. Applicants should have programming skills in two high-level languages (one of them block structured) and mastery of the standard curriculum in computer architecture, data structures, and operating systems, as well as a working grasp of calculus and statistics. Decisions on financial assistance are made on March 15.

Course Requirements

Students must complete 6 Computer Science courses numbered between 600 and 689, as well as one credit of CS 690. CS 695 may be taken for a maximum of 6 credits. Three credits of CS 695 may be counted as one of the six
600-level CS courses. CS 625 cannot count as one of the six 600-level courses, and can be taken for a maximum of 3 credits. Students complete requirements through either Plan A or Plan B. Plan A requires 45 graduate credits, including 9 to 15 credits of Thesis and Research. Plan B requires 51 graduate credits, including 3 credits of Thesis and Research. No more than two courses used to satisfy these requirements will be accepted with grades below B-, and none will be accepted with grades below C.

Graduate-level courses taken outside the department should be approved prior to registration by the candidate’s committee.

Graduate students with low GRE subject exam scores are required to pass the five departmental placement exams (Computer Architecture, Algorithms, Operating Systems, Compilers/Programming Languages, Automata Theory) upon entrance. As an alternative, students may choose to pass any of the following corresponding courses at USU, within one year, with a grade of B- or better: CS 355 and 356 (architecture), 220 (algorithms), 410 (operating systems), 530 (compilers) or 470 (programming languages), and 510 (automata).

Requirements change from time to time, so students are advised to check with the department or their adviser to determine whether the requirements at the time of graduation or in the first quarter of registration as a graduate student will have effect.

**Financial Assistance**

Applicants for admission will automatically be considered for financial aid, with no need for additional application procedures. Continuing students will be requested to apply for aid during the spring quarter. Acceptance into the program does not guarantee financial assistance.

**Computer Science Courses**

505. Parallel Programming. Programming methodologies for highly parallel computers. Topics include concurrent programming, distributed programming, and implementation issues. Prerequisite: CS 410. (3W)

516. Finite Automata Computability and Complexity. A treatment of formal grammars, finite and push down automata, Turing machines, and the theory of computability, decidability, and complexity. Prerequisite: CS 220. (3Sp)

*511. Distributed and Parallel Operating Systems. Concepts and methods for distributed consensus, reliability and recovery, concurrency control, deadlock, mutual exclusion, file systems, and related topics. Prerequisite: CS 410 or consent of instructor. (SP)


518. Information Systems Development. Life cycles, politics, technology, techniques of design, and implementation. Files, interface, testing, input/output, reports, processes. Database applications. Implementation of a commercial quality system. Prerequisite: CS 517. (4F)

525. Computer Modeling and Simulation. Introduction to simulation and comparison with other techniques. Discrete simulation models and discrete change simulation. Analysis of data generated by simulation experiments and validation of simulation models and results. Prerequisites: statistical methods and computer programming. (3W)

528. Graphical User Interfaces, the OSF/Motif Toolkit, and the X-Win System. Design principles of GUIs and the philosophy, structure, and programming of X-Windows applications using Motif. Prerequisites: CS 320 and C programming. (3F)


541, 542. Computer Graphics. A two-quarter sequence introducing the concepts of graphics techniques and digital representation of information. Prerequisite: CS 172 or 260 or consent of instructor; CS 541 must be taken prior to 542. (3F)

549. Expert Systems and Applied Artificial Intelligence. Expert systems and other problem solving techniques. Existing tools used to solve practical problems. Prerequisite: familiarity with a high-level programming language and the use of computers. (3F)

553. Computer Vision and Pattern Recognition I. Application of computer to vision and pattern recognition. Image formation, image processing, motion analysis, syntactic and statistical pattern recognition. Prerequisites: CS 220 and Math 321 or permission of instructor. (3W)

555. Algorithms. Study of algorithms and complexity analysis including priority queues, equivalence relations, search trees, geometric algorithms, greedy, divide and conquer, dynamic programming, iterative methods, parallel and distributed algorithms. Prerequisite: CS 220. (3W)

*556. Design and Analysis of Parallel Algorithms. Parallel complexity classes, models of parallel computation, and trade-offs between parallelism, programming, and performance. Parallel algorithms in a wide variety of areas. Prerequisite: CS 555. (3Sp)

560. Artificial Intelligence I. An introduction to artificial intelligence languages. LISP and PROLOG, programming techniques, and applications of these two languages to some simple AI problems. Prerequisite: CS 220 or consent of instructor. (3F)

571. Topics in Computer Science (Topics). Current topics in computer science, as determined by advances in the field. For advanced undergraduate or graduate students. Prerequisite: advanced standing as a CS major or permission of instructor. (1-6F, W, Sp, Su)

*577. Distributed Software Systems. Introduction to distributed software systems, including client/server and peer architectures, transparency, file and directory services, remote procedure calls, migration and replication strategies, collaborating servers, and security. (3F)

595. Independent Study. Provides for independent study of selected topics. Prerequisite: Permission of instructor. For use in the Ogden area only. (3-4F, W, Sp, Su)

605. Advanced Parallel Programming. An advanced course in parallel programming. Topics include fine-grained synchronization, semaphores, conditional critical regions, monitors, asynchronous message passing, synchronous message passing, and RPC. (3Sp)

607 (d507).1 Algorithms for Digital Signal Processing. A study of algorithms essential to digital signal processing applications. Topics will include Fourier transforms, convolution, digital filters, and estimation. Speech recognition techniques will be examined. Prerequisites: CS 172 and Math 222. (3F)

610. Operating Systems. Presents a survey of operating systems theory and functions, as well as advanced concepts. Prerequisite: CS 410 or consent of instructor. (3F)


*616. Structured Systems Analysis and Design. Classical life cycle, data flow diagrams, data dictionary, system specifications is structured English, file creation from data flows, system design. Prerequisites: CS 517 and 518. (3F)


625. Cooperative Work Experience, Graduate. Provides credit for students who work at a participating firm under faculty supervision. (1-9F, W, Sp, Su)

**628. Object-Oriented Models and Methods. Study of object-oriented concepts, principles, techniques, development processes, and tools across all areas of software engineering, with special emphasis on current research topics. (3F)

627 (d527). Software Engineering. Advanced techniques for software development, concentrating on project management, analysis, specification, and design. Prerequisite: CS 427. (3W)
638. Software Engineering. Software design methodology, design of reliable software, software testing and fault-tolerance, program analysis and verification, structured programming, software performance evaluation, language design for programming reliability. Prerequisite: CS 627/627. (3Sp)


633. Massive Parallelism. Study of computer techniques for generating code for parallel processors. These techniques are applicable for both coarse and fine grain parallelism. (3W)

641. Advanced Computer Graphics. A one-quarter graduate course to further develop the concepts and techniques of interactive computer graphics. Visual realism will be stressed. Prerequisite: CS 542 or permission of instructor. (3Sp)

650. Artificial Intelligence II (Advanced Topics). Study of the foundations of artificial intelligence. Topics include heuristic search, knowledge representation, deductive reasoning, game playing, and uncertainty reasoning. Prerequisite: CS 560 or consent of instructor. (3W)

651. Selected Topics in Artificial Intelligence. Topics of current interest in artificial intelligence, as chosen by the instructor, are presented to graduate students. Prerequisite: CS 650 or permission of instructor. (3Sp)

653. Computer Vision and Pattern Recognition II. Computer applications in vision and pattern recognition, including image transformations, 3-D images, enhancements, segmentation, clustering analysis, classifiers, and feature/primitive extraction. Prerequisite: CS 553 or permission of instructor. (3)

654. Theory and Application of Neural Networks. Introduction to the theory and application of neural networks. Students will build and test software-based emulators for the more popular types of neural networks. Prerequisite: CS 607/607 or permission of instructor. (3W)

671. Topics in Computer Science (Topic). Topics of current interest, as chosen by the instructor, are presented to graduate level students in Computer Science. Prerequisite: CS 220 or permission of instructor. (1-3F, W, Sp, Su)®

690. Seminar. Developments in computer science and current research interests will be presented. Some presentations by students. Offered pass-fail only. Prerequisite: graduate standing or permission of instructor. (1-5W)®

695. Reading and Reports. (3-6)®

697. Thesis and Research. (1-9)®

699. Continuing Graduate Advisement. (1-3)®

1Parenthetical numbers preceded by d indicate a dual listing.
® Repeatable for credit. Check with major department for limitations on number of credits that can be counted for graduation.
†Taught 1995-96.
**Taught 1996-97.

Department of Economics
College of Agriculture and College of Business

Head: Professor Donald L. Snyder, agricultural and resource economics
Office in Business 611, 797-2310

Graduate Program Coordinator: Professor John E. Keith, agricultural and resource economics

Professors Dee Von Bailey, agricultural economics; Basudeb Biswas, international trade, economic development; Reed R. Durtschi, economic theory; Herbert H. Fullerton, agricultural and regional economics; E. Bruce Godfrey, agricultural and resource economics; Terrence F. Glover, production economics and policy; Gary B. Hansen, manpower economics, industrial relations; Bartell C. Jensen, quantitative economics; W. Cris Lewis, regional-urban and managerial economics; Kenneth S. Lyon, economic theory; Darwin B. Nielsen, agricultural and resource economics; H. Craig Peterson, regulation and antitrust and managerial economics; Professors Emeritus Roice H. Anderson, Rondo A. Christensen, Lynn H. Davis, Allen D. LeBaron, N. Keith Roberts, Morris H. Taylor; Associate Professors Larry K. Bond, agricultural economics and finance; Christopher Pawson, public finance and econometrics; L. Dwight Israelsen, comparative systems and economic history; Associate Professors Emeritus Lloyd A. Clement, Glenn F. Marston; Assistant Professors Christopher B. Barrett, economic development and agricultural production; Leslie J. Reinhorn, macroeconomics and economic theory; Dawn D. Thilmany, agricultural economics, finance, trade and policy; Lecturer Tyler J. Boutles, econometrics and international economics; Extension Specialist—Human Resources Marion T. Bentley, manpower economics

Degrees Offered: Master of Science (MS) and Master of Arts (MA) in Economics and in Agricultural Economics, Master of Community Economic Development (MCED), participates in Master of Social Sciences (MSS), Doctor of Philosophy (PhD) in Economics

Specializations: MS and MA—Agribusiness, Managerial Economics, Traditional Program; PhD—Natural Resource Economics, Trade and Development
Application Requirements

See general admission requirements, pages 25-26. Applications for graduate study from students trained in disciplines other than economics are welcomed. Generally, such applicants are required to enroll in intermediate macroeconomics, microeconomics, and mathematical economics as prerequisites to entering the degree program. Prospective students should also have completed the equivalents of undergraduate courses in college algebra, introductory calculus, and statistics. Applicants are also expected to have strong written and oral communications skills as should be developed in any substantive undergraduate program.

Degree Requirements

Doctor of Philosophy in Economics. To obtain a PhD in Economics, a student must meet requirements for admission to candidacy, prepare a dissertation, and pass the final dissertation examination.

As minimum prerequisites, students considering the PhD program in economics should have taken the following courses by full of their first full year of study: Econ 500, 501, 531, 532, and 533 (or their equivalent).

Admission to candidacy is granted upon completion of the following: (1) Econ 600, 601, 602, 604, 631, 643, 644, 647, 692, 700, 701, 733; (2) Econ 720, Applications of Microeconomics; (3) one of the following field areas including (a) Econ 755 (with Econ 554, 556, and 656 strongly recommended as background courses); (b) Econ 780 (with Econ 540, 580, 640, and 680 strongly recommended as background courses); (c) BA/Econ 760 (with BA 642, 644, and 645 strongly recommended as background courses); (4) courses, as determined by the student's supervisory committee, taken from the following areas: (a) quantitative methods, (b) history/comparative systems, (c) public finance, (d) trade/development, (e) agriculture, (f) natural resources, and (g) labor/human relations; (5) successful performance on a written qualifying examination covering economic theory which must be taken the spring following the first full year of study; and (6) preparation of a dissertation prospectus and approval by the Graduate Committee.

Master of Science and Master of Arts in Agricultural Economics. Option I: Traditional Program. To qualify, a student is required to earn a minimum of 45 credits to include the following: (1) Econ 500 and 501 (or their equivalent) as prerequisites (not applied toward degree); (2) Econ 600, 601, 602, 604, 631, 643, 644, 645, 647, and 692; (3) four additional courses (at least one of which is 600 level or above) from (a) quantitative methods, (b) history/comparative systems, (c) public finance, (d) trade/development, (e) agriculture, (f) natural resources, (g) labor/human relations, (h) econometrics, and (i) economic theory; and (4) successful completion of a final examination.

Option II: Agribusiness Specialization. To qualify for this Plan C degree, a student is required to earn a minimum of 52 credits in the following: (1) Econ 500 and 501 (or their equivalent) as prerequisites (not applied toward degree); (2) Econ 531, 532, 600, 606, 633, Acctg 601 and 602, BA 642, and Econ 601 or BA 635; (3) Econ 643, 644, and 692 or Econ 645 and 647; (4) five additional courses (at least three of which are 600 level or above) from at least two areas including (a) quantitative methods, (b) history/comparative systems, (c) public finance, (d) trade/development, (e) agriculture, (f) natural resources, (g) labor/human relations, (h) econometrics, and (i) economic theory; (4) 9 credits for a thesis or 3 credits for a Plan B paper; and (5) successful completion of a final examination.

Master of Science and Master of Arts in Economics. Option I: Traditional Program. To qualify, a student is required to earn a minimum of 45 credits to include the following: (1) Econ 500 and 501 (or their equivalent) as prerequisites (not applied toward degree); (2) Econ 600, 601, 602, 604, 631, 643, 644, 645, 647, and 692; (3) four additional courses (at least one of which is 600 level or above) from (a) quantitative methods, (b) history/comparative systems, (c) public finance, (d) trade/development, (e) agriculture, (f) natural resources, (g) labor/human relations, (h) econometrics, and (i) economic theory; and (4) successful completion of a final examination.

Option II: Managerial Economics Specialization. To qualify for this Plan C degree, a student is required to earn a minimum of 52 credits in the following: (1) Econ 500 and 501 (or their equivalent) as prerequisites (not applied toward degree); (2) Econ 531, 532, 600, 606, 633, Acctg 601 and 602, BA 642, and Econ 601 or BA 635; (3) Econ 643, 644, and 692 or Econ 645 and 647; (4) five additional courses (at least three of which are 600 level or above) from at least two areas including (a) quantitative methods, (b) history/comparative systems, (c) public finance, (d) trade/development, (e) agriculture, (f) natural resources, (g) labor/human relations, (h) econometrics, and (i) economic theory; and (4) successful completion of a final examination.

Master of Community Economic Development. To qualify, a student is required to earn a minimum of 51 credits for a Plan B degree, to include the following: (1) Econ 500 and 501 (or their equivalent) as prerequisites (not applied toward degree); (2) Econ 530, 531, 532, 600, 606, 633, Acctg 601 and 602, BA 642, and Econ 601 or BA 635; (3) Econ 643, 644, and 692 or Econ 645 and 647; (4) five additional courses (at least three of which are 600 level or above) from at least two areas including (a) quantitative methods, (b) history/comparative systems, (c) public finance, (d) trade/development, (e) agriculture, (f) natural resources, (g) labor/human relations, (h) econometrics, and (i) economic theory; and (4) successful completion of a final examination.

Master of Social Sciences. This degree is an interdisciplinary program with a specialization designed for economics students. General requirements for the degree are found on pages 41-42. To qualify, a student is required to earn a minimum of 51 credits based on (1) a minimum of 24 credits in Economics which must include Econ 500, 501, 506, 633, and 692 (or their equivalent); (2) a minimum of 12 credits in (a) two social science minors or (b) one social science minor and one social science cluster; and (3) 3 credits in a comprehensive integrative experience or Plan B report. Areas of emphasis include (a) quantitative methods, (b) history/comparative systems, (c) public finance, (d) trade/development, (e) agriculture, (f) natural resources, (g) labor/human relations, (h) econo-
metrics, and (i) economic theory. The disciplines from which the minors or minor/cluster may be selected include two of the following: Anthropology, Business Administration, Computer Science/Instructional Technology, Family and Human Development, Geography, History, Management and Human Resources, Political Science, Psychology, Sociology, and Social Work.

Research

The department maintains an active and productive research program. All faculty members are involved in investigating problems in economics and agricultural economics. The results of this research are published regularly in professional journals, books, and other publications. Financial support for the department research program is provided by the Utah Agricultural Experiment Station, the Colleges of Agriculture and Business, the Office of the Vice President for Research, and from outside funding sources. The Economics Research Institute provides support and coordination for some of the department's research activities. Generally, graduate students are an integral part of all departmental research programs.

Financial Assistance and Assistantships

The department offers a variety of teaching and research assistantships to qualified graduate students. These are awarded on a competitive basis and interested students should request the Application for Financial Assistance form from the department. While the department makes every effort to assist students in obtaining financial assistance, acceptance into department programs does not guarantee financial assistance.

Some graduate students with demonstrated ability to contribute to departmental teaching and research functions are provided with financial assistance. No financial assistance is given to PhD students not passing the first-year qualifying examination or to any graduate student not making satisfactory progress toward his or her degree.

Economics Courses

500. Macroeconomics. Analysis of the underlying causes of unemployment, economic instability, inflation, and economic growth. Prerequisite: Econ 200 or consent of instructor. (4F,Sp,Su)

501. Microeconomics. Analysis of the behavior of consumers and business firms. Application of theory to the solution of real world problems. Prerequisite: Econ 201, Math 215 or its equivalent, or consent of instructor. (4F,W,Sp)

502. Public Policy for Agriculture. A study of agricultural policies and their impacts on product and factor markets, with major focus on an economic analysis of public policy actions. Prerequisite: Econ 200 or 201. (3Sp)

503. Agricultural Marketing. Principles and functions of marketing as applied to agriculture. Prerequisite: Econ 201 or 303. (3F)

504. Applied Price Analysis. Concepts and applications of price forecasting and contract trading. Prerequisite: Econ 201 or 303. (3W)

510. History of Economic Thought. Origin and development of economic theories of leading thinkers in western civilization from 1750. Prerequisites: Econ 200 and 201. (3W)

511. Economic History of the United States. Development of agriculture, industry, transportation, and finance from colonial times. Prerequisites: Econ 200 and 201. (3W)

513. Economic History of Russia. Development of the Russian economy from earliest times to 1930, emphasizing the interaction between economic forces and policies of the state. Prerequisites: Econ 200 and 201. (3Sp)

515. Comparative Economic Systems. History, economic theories, and comparative policies of communist, socialist, and capitalist economies. Prerequisites: Econ 200 and 201. (3Sp)

516. Economic Transformation of Russia and Eastern Europe. Description and analysis of the contemporary economic systems of Russia and Eastern Europe with emphasis on problems of economic policy and central planning. (3Sp)

520. Introduction to Labor. A review of the development of labor-management relationships and the growth of trade unionism in the United States. (3F)

521. Industrial Relations and Collective Bargaining. A comprehensive study of the bargaining process and scope of labor-management contracts, the day-to-day administration of agreements, and the major substantive issues in negotiations. (3W,Sp)

522. Labor Force Analysis and Manpower Economics. Labor force development and behavior, occupational choice and mobility, human capital formation, labor market information and institutions, and manpower policies. (3W)

523. Trade Unionism and the Law. A survey of the law governing labor relations. The legal framework in which the collective bargaining relationship is established and in which negotiations take place is analyzed. (3Sp)

524. Economics of the Cooperative and Worker-owned Enterprise. Provides the student with an understanding of the structure and functioning of industrial cooperatives and other types of worker-owned enterprises in the U.S. and abroad. (3Sp)

530. Business and Government. Description and analysis of government-business interaction: antitrust, price and entry regulation, consumer protection, government enterprise, patents, price controls. Prerequisite: Econ 201. (3Sp)

531 (F576). Applied Mathematical Economics—Optimization. Economic applications of basic mathematics, including algebra and calculus (differentiation and integration). Prerequisite: Math 215 or equivalent. (3F)

532 (F576). Economic Applications of Matrix Algebra. Economic applications of matrix algebra (input-output models and linear and nonlinear programming). Prerequisite: Econ 531 or its equivalent. (3W)

535. Agribusiness and Cooperatives Management. Applications of economic and management principles to farm marketing and supply firms. Management teams operate computer simulated farm supply firms in competition with each other. Prerequisites: Econ 201 and Acctg 201; or consent of instructor. (3Sp)

540. International Economics. Primary issues in international economics including comparative advantage, trade restrictions, balance of payments, and alternative international monetary systems. Prerequisite: Econ 401 or 501. (4W)

550. Public Finance. Government fiscal institutions-expenditure programs, budget procedures, tax systems, debt issues, levels of government, and the issues surrounding their operations. Prerequisite: Econ 401 or 501. (3F,Sp)

551. State and Local Finance. Unique financial problems of state and local governments. (2W)

554. Guide to Benefit Cost Analysis and Interpretation. Terminology, data arrangement, economic and financial considerations required in preparation of project feasibility and funding documents. Lecture plus workshop format. (3W)

556. Natural Resource Economics. Economics of developing, managing, and conserving natural resources. Topics include resource use and conservation, environmental quality, public and private resource management, and valuation of nonmarket goods. Prerequisite: Econ 401 or 501. (3F)

560. Money and Banking. Development of our present monetary and banking system, a critical analysis of central banking. Prerequisite: Econ 400 or 500 or consent of instructor. (4Sp)

580. Economics of Less Developed Countries. Theories of economic development, characteristics, and problems of less developed and developing countries, alternative techniques and policies for the promotion of growth and development. Prerequisite: Econ 200 or 201. (3F)

585. Regional and Urban Economics. Building on macroeconomic theory, models for regional and urban structure and change are explored. Policy decision models are also developed. Prerequisite: Econ 201. (3F)

595. Senior Agricultural Economics/Economics Project. A current problem related to agricultural economics and/or economics is identified
and analyzed, bringing together other agricultural economics and economics course concepts and methods (3Sp).

600. Income Theory. Theories of aggregate economic behavior in closed and open economies, with emphasis on formulation of policies designed to promote full employment, price stability, and economic growth. Prerequisites: Econ 500 or consent of instructor and applied calculus, Econ 531 or its equivalent. (4F)

601. Price Theory I. Technology, theory of the firm, economics and organization, consumption, uncertainty, general equilibrium. Prerequisites: Econ 501 or consent of instructor and applied calculus, Econ 531 or its equivalent. (4F)

602. Price Theory II. Theory of markets, strategic behavior and theory of games, theory of capital, asset markets, theory of information, externalities, public goods, and public choice. Prerequisites: Econ 501 or consent of instructor and applied calculus, Econ 531 or its equivalent. (4W)

603. Agricultural Marketing and Policy. An applied marketing course dealing with application of economic theory to solution of current marketing problems. Prerequisite: Econ 501 or consent of instructor. (3Sp)

604. Dynamic Macroeconomics. Advanced macroeconomic theory including dynamic models of the economy and expectations. Prerequisite: Econ 600 or consent of instructor. (4W)

606. Research Methods. Philosophy of research and importance of application of scientific method to solution of research problems. (3W)

608. Theory and Methods of Community Economic Development. Multidisciplinary approaches to analyzing community economic development issues in rural and urban settings. Prerequisites: Econ 200 and 201. (3Sp)

609. Community Economic Development Project and Seminar. Provides the framework within which students conceptualize and develop their CED projects. Prerequisite: Econ 200 or 201. (3Su)

625. Graduate Internship. For the practicing professional who wishes to upgrade his or her experience in an occupational assignment. One credit per 75 hours of experience. Maximum of 6 credits. (1-6F,W,Sp, Su)®

626. Economics of New Work Systems. Analysis and development of understanding and skills toward efficient use of human and other resources in maintaining productive organizations. (3F)

631. Advanced Mathematical Economics. Advanced mathematical theory and techniques as applied to economics, including optimization, comparative statics, dynamics, and differential equations. Prerequisites: Math 105, 215, Econ 501, 531. (3F)

633 (d533). Applied Econometrics. Application of basic statistics, simple linear regression, multiple regression, and simultaneous equations to economic models. Prerequisites: Math 215 or equivalent; Econ 531 or its equivalent; Stat 230, or Stat 501 or 502, or their equivalent; or consent of instructor. (3Sp)

640. International Economics. International trade theory and policy. Most recent developments in international economics, as well as the traditional core of the subject including Ricardian Theory and Heckscher-Ohlin Theory, are covered. The monetary portion includes asset market approach to exchange rate determination. Focuses on theory, followed by application of the theory to major policy questions. Prerequisite: Econ 540 or consent of instructor. (3F)

643. Econometrics I. An analysis of the commonly used and practiced techniques for estimating and testing linear econometric models. For first-year graduate students. Prerequisites: calculus and statistics, or consent of instructor. (3W)

644. Econometrics II. Empirical estimation and testing of linear simultaneous equation models. Prerequisite: Econ 643 or consent of instructor. (3Sp)

645. Operations Research. Linear programming, resource allocation models, duality theory, transportation and assignment problems, and post-optimal analysis. Prerequisites: Econ 531 and 532; BA 308 or equivalent, or consent of instructor. (3Sp)

647. Business Forecasting Methods. Discussion and evaluation of business forecasting techniques. Topics include survey design and administration, trend projection, econometric models, and input/output analysis. Pre-requisites: Math 215 and Econ 531 or their equivalent; Stat 230, or Stat 301 or 502, or their equivalent; or consent of instructor. (3F)

656. Resource Economics. Allocative and distributive implications of using natural resources, including exhaustible, renewable, environmental, and nonmarket resources. Prerequisite: Econ 501 or equivalent, basic calculus (Econ 531 or its equivalent) or consent of instructor. (3F)

666 (d566). Training and Organizational Development. Theoretical basis for training and development in organizations. Practical experience in the design and development of training and other educational programs in the organizational setting. For graduate students. (3Sp)

680. Economic Development. Theories of economic development with emphasis on measurement and empirical analysis. The concept of human development is emphasized, in addition to an explanation and determinants of economic growth in developing countries. Prerequisite: Econ 580 or consent of instructor. (3W)

690. Readings and Conference. Credits from this course toward any Economics graduate degree require approval of the student's advisory committee, the department graduate committee, and the department head. (1-5F, W, Sp, Su)®

691. Independent Research. Credits from this course toward any Economics graduate degree require approval of the student's advisory committee, the department graduate committee, and the department head. (1-5F, W, Sp, Su)®

692. Graduate Seminar in Economic Studies. Seminar for graduate students in which students will present their research papers to faculty and other students. (1F, W, Sp)®

697. Thesis. (1-12F, W, Sp, Su)®

699. Continuing Graduate Advisement. (1-3F, W, Sp, Su)®

700. Advanced Macroeconomics Seminar. Income, monetary, and fiscal analysis. Prerequisites: Econ 600, 604, and Math 631, or consent of instructor. (3Sp)

701. Price Theory I. Consumer demand, the product market, production and factor demand, factor supply, economics of uncertainty, welfare economics, and general equilibrium. Prerequisites: calculus, Econ 631 or its equivalent, Econ 601 and 602, or consent of instructor. (3Sp)

720. Topics in Applied Microeconomics. Current research topics in the application of microeconomic theory to production, consumption, and welfare policy, market behavior, and general equilibrium issues. Prerequisites: Econ 790, 701, and 733, or consent of instructor. (3W)

733. Advanced Econometrics Seminar. Theory and applications of linear and nonlinear regression using quantitative and qualitative variables, simultaneous equations, and advanced topics in estimation. Prerequisites: calculus, Econ 631, 643, 644, or their equivalent; or consent of instructor. (3W)

755. The Economics of Natural Resource Use Seminar. Advanced topics in economic theory of optimal natural resource use under alternative assumptions of property rights, externalities, and uncertainty. Prerequisites: calculus, Econ 601, 656, and Econ 631 or its equivalent. (3W)

760. Seminar in Financial Topics. Doctoral seminar in current finance theory. Topics will include current issues in investments, portfolio theory, corporate finance, capital markets, speculative markets, and financial institutions. (3Sp)

780. Economic Development/Trade Seminar. Economic theory and econometric methods of analyzing development, trade, and exchange are discussed. Prerequisites: Econ 640 and 680. (3Sp)


799. Continuing Graduate Advisement. (1-3F, W, Sp, Su)®

*Taught 1995-96.
**Taught 1996-97.

1 Parenthetical numbers preceded by d indicate a dual listing.
2 Repeatable for credit. Check with major department for limitations on number of credits that can be counted for graduation.
Department of

Electrical and Computer Engineering

College of Engineering

Head: Professor Richard W. Harris, communications, signal processing
Office in Engineering Laboratory 149, 797-2840

Professors Doran J. Baker, electromagnetics, infrared measurements, engineering systems in space; Kay D. Baker, electronics, space science; Joe R. Doupnik, communications, computers; Robert W. Gunderson, control systems, pattern recognition; Ronnie D. Harris, microwaves, transmission line circuits, atmospheric modeling; Linda S. Powers, biophysics, molecular engineering; Alan W. Shaw, electromagnetics, controls, microcomputers; Allan J. Steed, infrared, electro-optical, aerospace measurement systems; Gardiner S. Stiles, parallel computation systems; Ronald L. Thurgood, computers, database systems; Research Professors David A. Burt, aerospace measurement systems; James C. Ulwick, aerospace physics; Professors Emeritus Clayton Clark, antennas; Bertis L. Embry, power systems; Clair L. Wyatt, infrared, electro-optical systems; William L. Jones, integrated circuits; Adjunct Professors Stephen E. Bialkowski, optical spectroscopy, optical signal processing, digital signal processing; Douglas M. Chabries, signal processing; Bela Gulya Fejer, space physics and radar systems; Boyd P. Israelsen, microwaves; Associate Professors John C. Kemp, robotics, electro-optics; Paul A. Wheeler, microprocessors, telecommunications, signal processing; Research Associate Professors J. Steven Hansen, computer signal processing; Ronald J. Huppi, electro-optics; Adjunct Associate Professors Lloyd G. Allred, neural networking; Heng-Da Cheng, pattern recognition, image processing; Wynn C. Stirling, detection and estimation theory; Associate Professor Emeritus Duane G. Chadwick, remote sensors, instrumentation; Assistant Professors Ben A. Abbott, computer engineering; Scott E. Hudge, signal processing, image processing; Todd K. Moon, communications and signal processing; Charles M. Swenson, atmospheric science and space engineering; Research Assistant Professors Paul D. Israelsen, electronics; Larry L. Jensen, instrumentation and measurements; Stephen B. Turcotte, optics instrumentation; Adjunct Assistant Professors Ali Ghafourian, data compression; Chien-Min Huang, image processing; Adjunct Research Assistant Professor L. Carl Howlett, aerospace electronics and electro-optics

Degrees offered: Master of Engineering (ME), Master of Engineering Science (MES), Master of Science (MS), Electrical Engineer (EE), Doctor of Philosophy (PhD)

Specializations: Atmospheric and Space Sciences, Communications, Control and Optimization, Infrared and Optical Systems, Microelectronics (VLSI), Microwaves (MMIC), Parallel Computers and Digital Systems, Signal Processing

Admission Requirements
See general admission requirements on pages 25-26. Applicants with a bachelor’s degree in Electrical Engineering from an ABET accredited program and having a 3.0 GPA or better can generally be admitted without restriction. Additional coursework in electrical and computer engineering fundamentals may be required in individual cases. Students must take the general GRE exam; however the subject GRE is not required. All graduate students are expected to have or acquire a working knowledge of application computer languages such as C, Pascal, and Fortran.

Degree Requirements
The graduate program of courses can be grouped into the areas of (1) computer architecture and digital systems; (2) information, communications, and controls; and (3) electromagnetics and electro-optics. Specific requirements for the ME, MES, MS, EE, and PhD degrees are outlined below; these are in addition to the general requirements of the Graduate School. (See pages 30-33.)

Master of Engineering and Master of Science. Successful completion of 45 credits of 500-level or above graduate-level coursework is required. Students must successfully complete 18 credits (excluding thesis and seminars) in the Electrical and Computer Engineering Department graduate program at the 500 level or above.

Both a depth and breadth in coursework must be demonstrated as follows: (a) demonstrate depth by completing two different two-course sequences at the 600 level or above. For example, ECE 631, 732, and ECE 640, 641 would satisfy this requirement; (b) demonstrate breadth by completing four courses in different areas. Two of these breadth courses can be from the depth courses. Also, two of the breadth specialties may be at the 500 level. For example, ECE 554, 581, 631, and 640 satisfy the breadth requirement.

Successful completion of 21 credits (excluding thesis and seminars) at the 600 level or above in Electrical and Computer Engineering and related fields (e.g., Mathematics, Physics, Computer Science, or Mechanical and Aerospace Engineering) is required. The 600-level credits required above may be part of the 21 credits for this requirement. Some 500-level mathematics courses may be approved as part of the 21 credits.

Successful completion of a minimum of 9 and a maximum of 15 credits of thesis (for MS degree) is required. Thesis credit is in addition to the 600-level required credits above. The ME degree does not require a thesis, but requires three 500-level or above courses with a laboratory.

Engl 305, Technical and Professional Writing, or the equivalent writing experience is required for MS students prior to beginning the thesis.
If a student is funded for his/her master’s degree program by a fellowship or research funds, he/she is expected to complete the MS degree. If a student (funded or not) chooses an MS degree, changing to the ME degree is only possible by approval of the major professor, ECE graduate committee, and the department head.

**Electrical Engineer.** The Electrical Engineer degree is awarded for the successful completion of an advanced program of 90 credits of academic work beyond the BS, or 45 credits beyond the MS, and a comprehensive engineering report earning an additional 15 credits. The degree requirements are the same as those for the PhD listed below, except that the comprehensive examination need not be taken and the engineering report is given in lieu of the original research dissertation, reducing the total credits required for the PhD. The degree differs from the PhD by preparing the student for professional engineering work rather than for research.

**Doctor of Philosophy.** The PhD is awarded for the successful completion of an advanced program of academic work and original research. A flexible program is planned individually by each candidate in consultation with his/her faculty supervisory committee. The PhD program is expected to include 90 credits of class work beyond the BS degree plus 45 credits of dissertation research. The coursework generally represents two years of study beyond the MS degree, with up to 30 credits being taken outside the Electrical and Computer Engineering Department. For acceptance into the PhD program, applicants should have the equivalent of an MS from an accredited program in the United States, preferably in fields related to electrical or computer engineering. In the department’s Outreach Program, cooperative graduate research efforts have been made with industry.

Once the student has completed at least 60 and not more than 90 credits, he/she must pass a comprehensive examination based on graduate-level courses. Near the end of the program, the results of the original (publishable) research work will be presented and publicly defended as a dissertation earning an additional 45 credits (ECE 797).

**Research**

The faculty lead research programs offering a wide variety of specialized topics which involve state of the art engineering, field work, and project management. The department is internationally recognized as a center for space engineering. Major research programs are associated with the Electrical and Computer Engineering Department through the Center for Space Engineering, which coordinates graduate research with industry, government, and on-campus laboratories, including the Space Dynamics Laboratory, Center for Atmospheric and Space Sciences, the Center for Self Organizing and Intelligent Systems, and the National Center for the Design of Molecular Function. Research in these laboratories and centers is conducted on atmospheric space science and space instrumentation, including infrared sensors, linear and nonlinear control systems, neural networks, parallel processing, computer networking, real-time computer controls, communications, and image processing.

Many faculty members and students are working with experiments carried on the space shuttle. These projects range from small packages developed by the students to major experiments supported by teams of engineers and scientists. Opportunities exist in these programs for student participation.

The department also has research programs in VLSI, computer networking, parallel processing, MMIC, robotics, microwaves, and signal processing. Interdisciplinary programs have been developed with other engineering departments, with Physics, Chemistry and Biochemistry, and Mathematics and Statistics, and in agriculture and water resources areas.

**Financial Assistance**

All applicants who are accepted academically are automatically considered for financial aid. Although there is limited financial aid, virtually all successful graduate students in the department do receive some level of financial aid during their degree program.

**Electrical and Computer Engineering Courses**

506. VLSI Design Techniques. Basic course in microwt1cut design, modeling, and simulation. Computer-aided analysis for VLSI design and verification. Study of NMOS and CMOS processes. (3F)

510, 511. Control Systems. Analysis and design of control systems. Transfer function and state space techniques in the engineering of continuous and discrete control systems. Three lectures, one lab. Prerequisites: ECE 313, 41F. (4W)

515. Operating Principles, Dynamics, and Modeling of Control Actuators. Operating principles, static and dynamic characteristics, modeling, and application of electrical motors as control actuators. Introduction to basic physical principles of control sensors. Prerequisites: ECE 308 and 313. Three lectures, one lab. (4S)

525. Spacecraft Avionics and Telemetry Systems. Spacecraft electrical and electronics subsystems, i.e., guidance, navigation, and control; command and data handling; electrical power generation and storage; and special requirements of the space environment. Three lectures. Prerequisites: ECE 211 and 251. (3S)

*528. Electronic Music Systems Engineering. Engineering analysis and design of electronic music systems. Includes acoustics of musical instruments, analog and digital synthesizers, and MIDI protocols. Three lectures, one lab. (4F)

**529. Sound System Design. Sound system design based on engineering principles. Includes measuring parameters in the acoustic environment, designing the power amplification system, and selection of microphones and loud speakers. Three lectures, one lab. (4P)

540, 541. Microwave Electronics. Circuit parameters and design techniques for distributed circuits, active and passive microwave devices. Three lectures, one lab. Prerequisites: ECE 315 and 347. (4W) (3S)

542. Antennas and Radiation. Theory and applications of electromagnetic radiation and radiative structures. Three lectures, one lab. (4P)


551. Real-time Digital Signal Processing. Applications of DSP principles using real-time processors. Includes C and assembly language programming, modern DSP processor architecture, and finite word-length effects. Laboratory includes implementation of a hardware-based real-time system. Prerequisite: ECE 550. (4P)

554. Communication Systems. Engineering of analog and digital communication systems. Signal analysis, modulation-demodulation, channel
properties, and introduction to communication standards and protocols. Prerequisite: ECE 312. Three lectures, one lab. (4W)

555. Computer and Data Communication Systems. Provides a systems approach to computer and data communication. Includes data transmission, computer interfaces, and protocols relating to local and wide area networks. Three lectures and one lab. Prerequisite: ECE 358. (Sp)

564. Solid-state Materials-devices. Modeling of electrical and electromagnetic characteristics of solid-state semiconductor materials. Operating principles of semiconductor and optical solid-state devices used in electrical engineering. Prerequisites: ECE 314 or Phys 461, Math 322. (Sp)

581. Applied Electronics. Electronic circuits and systems analysis and design of integrated circuit devices. Three lectures, one lab. Prerequisite: ECE 480. (4W)

588. Computer Structure. Theory and organization of computer structures: number representations, computer arithmetic, processors, control units, memories, interconnection networks, parallel architectures, and performance trade-offs. (Sp)

588. Microcomputer Interface Design. Design of hardware and software interfaces to microcomputers for instrumentation and control applications. Three lectures, one lab. Prerequisite: ECE 358. (Sp)

592. Teaching Engineering. Teaching principles, techniques, and laboratory experience in engineering. Instruction and experience in teaching engineering lectures, recitation, and laboratory sections. One scheduled session per week with other sessions arranged. Prerequisite: department head approval. (1-3F, W, Sp, Su)

593. Special Topics in Electrical Engineering. Independent or group study of engineering problems not covered in regular course offerings. (1-3F, W, Sp, Su)


607. Very Large Scale Integrated Circuit Design. Procedures for the design of VLSI circuits. Emphasis on top-down design. Structured, interactive computer-based layout and design verification techniques. A full circuit design is completed. Prerequisite: ECE 506. (4W)

608. Very Large Scale Integrated Circuit Design. Procedures for the design of VLSI circuits. Emphasis on top-down design. Structured, interactive computer-based layout and design verification techniques. A full circuit design is completed in ECE 607. Exposure to GaAs technology in ECE 608. (Sp)

*611, 612. Optical Engineering. Analysis and design of electro-optical devices and systems. Engineering and calibration of instruments using optical sources, fiber optics, lenses, beam splitters, modulators, and detectors, including cryogenic infrared devices. Prerequisite: Phys 223. (W, Sp)

620. Microwave Engineering. Theory of operation and design techniques for passive microwave components. Topics include transmission lines and waveguides, resonators, power dividers/combiners, filters, acoustic and ferrite devices. Prerequisite: ECE 540. (3F)

621. Microwave Engineering. Theory of microwave solid state devices. Design of amplifier, oscillator, mixer, multiplier, and switch circuits at microwave frequencies. (3F)

**622. Microwave Engineering. Design strategy for integration of microwave analog and digital circuits. Emphasis on CAE design techniques and processing for GaAs-MMIC's. (3F)

625. Graduate Internship/Co-op. Planned work experience in industry. Detailed program; must have prior approval. Written report required. (F, W, Sp, Su)

631. Space Science and Engineering. Study of the space environment, spacecraft mechanics, guidance, communication and telemetry systems; aeronautical and space measurement techniques, aerospace equipment design. (3F)

640, 641. Computer Networking. Topics include network topology, flow, capacity and queueing analysis, detailed description of the standard layers, and specific networking systems, including local area networks. A one-credit lab will be required with this course. (4F, 4W)

642. Analog VLSI Design. Design and analysis of MOS analog integrated circuits. Emphasis on circuit layout, simulation, and analysis. Topics include frequency response, feedback, amplifier noise, and circuit density. Prerequisites: ECE 506 and 581. (3F)

650. Digital Image Processing. Digital processing theory and techniques for two-dimensional signals. Topics include two-dimensional transforms, image perception, sampling, and enhancement. Prerequisite: ECE 550. (3F)


661, 662. Electromagnetics. First-year graduate-level electromagnetics concepts; incorporates computer-aided skills as applied to generation, radiation, and reception of waves in various media at frequencies throughout the electromagnetic spectrum. Offered every other year. (3F, Sp)

680. Electrical Engineering Colloquium. Weekly seminars or colloquia. (F, W, Sp)


695. Design Project. Individual projects involving the design, development, construction, and/or testing of components, devices, or systems. A formal report is required. (F, W, Sp, Su)

697. Thesis Research, MS. (3 F, W, Sp, Su)

699. Continuing Graduate Advisement. (1-5F, W, Sp, Su)

1704. Ionospheric Physics. See Phys 704. (3)

Chem 705. Atmospheric Chemistry and Photochemistry. See Chem 705. (3)


1711, 1712. Electro-optics. Geometrical and physical optics; optical devices; radiometric-electronic systems; Fourier optics; image formation; modulation and filtering; holography; random process and noise; information and data processing. Prerequisites: graduate standing and instructor's consent. (3F, W, Sp, Su)

732. Space Science and Engineering. Study of the space environment, spacecraft mechanics, guidance, communication and telemetry systems; aeronautical and space measurement techniques, aerospace equipment design. (Sp)

1742, 1743. Design and Analysis of Advanced Integrated Circuits. Advanced topics in the design of integrated circuits. Both digital and analog. Unique architectures, high speed circuits such as GaAs and multiple technologies. Heavy emphasis on computer-aided design and analysis. Prerequisites: ECE 642, ECE 608 or 622. (3F, W, Sp, Su)

750. Advanced Digital Signal Processing. Advanced digital signal processing theory and applications, including homomorphic processing, spectral estimation, adaptive filtering, and optimal (Wiener and Kalman) filtering. Prerequisites: ECE 550 and 601. (3F)

751. Advanced Digital Image Processing. Digital processing theory and techniques for two-dimensional signals. Topics include image enhancement, restoration, and data compression. Prerequisites: ECE 650 and 750. (3F)

752, 753. Advanced Control Theory. Topics in advanced control theory and practice. Prerequisite: ECE 653 and consent of instructor. (3F, W, Sp, Su)

1764, 1765. Digital Computer Architecture. Advanced topics in digital computer architecture with emphasis on state of the art parallel processing systems. (3W, 3Sp)

1770, 1771. Communications and Signal Processing Theory. Treatment of deterministic and stochastic signals imbedded in noise, auto and cross power spectra, correlation functions, advanced spectral estimation
methods, matched filtering. Prerequisite: ECE 601 must be taken prior to ECE 770. (3Sp) (3P)

278. Special Topics in Electrical Engineering. Independent or group study in electrical engineering topics, such as automated systems, laser engineering, electroacoustics, solid-state materials, devices, and intelligent systems engineering. (1-9F, W, Sp, Su) ®


799. Continuing Graduate Advisement. (1-12F, W, Sp, Su) ®

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### Department of Elementary Education

**College of Education**

**Head:** Professor Jay A. Monson, administration, gifted/talented education, social studies education
Office in Emma Eccles Jones Education 385A, 797-0385

**Professors** Deborah A. Byrnes, early childhood and social studies education; Donald R. Doug, science education, curriculum development; Bernard L. Hayes, reading education; Adjunct Professor Gary L. Carlston, curriculum development, administration; **Associate Professors** Francine Fukui Johnson, gifted/talented education, supervision; John A. Smith, reading education; Deanna D. Winn, supervision, foundations; **Assistant Professors** Martha T. Dever, early childhood education; James T. Dorward, mathematics, research methods, middle level education; Linda W. Ginn, foundations, early childhood; Deborah E. Hobbs, foundations, gifted and talented; Elizabeth J. Jared, language arts; Martin K. Tadlock, middle education; **Adjunct Instructor** William Prentiss Klag, curriculum, science

**Degrees offered:** Master of Arts (MA), Master of Science (MS), Master of Education (MEd); the Elementary Education Department participates in the Interdepartmental Doctoral Program in Education, Doctor of Education (EdD) and Doctor of Philosophy (PhD)

**Specializations for MA, MS, and MEd:** Early Childhood Education; Gifted and Talented Education, Reading, Writing, and Language Arts; Math and Science Education; Middle Education; Social Studies Education

### Admission Requirements

Students applying for admission to master's programs must have GRE scores at or above the 40th percentile. The same percentile is the minimum required on the MAT. For the doctorate degree, GRE scores at or above the 40th percentile are also required on the verbal and quantitative tests. Admission committees also consider experience, undergraduate record, curricula completed, and formal recommendations. One year of successful elementary school teaching experience is required for the master's program. Two years of teaching experience or the equivalent is required for admission to the doctoral program. Students with deficient oral or written English skills will be required to complete additional coursework to improve their skills.

Admission to graduate programs is contingent upon (1) completion of an application to graduate school and (2) recommendation by the department screening committee for the master's program or the management admissions committee for the doctoral program. In addition to the requirements of the School of Graduate Studies (see pages 25-26), letters of recommendation must be received from three professionals in education.

### Degree Programs

**Master's Degrees.** Three avenues exist for students wishing to pursue a master's degree in the Department of Elementary Education. They are as follows:

**Master of Education.** Students wishing to include a creative project as part of their master's degree program should enroll in the Master of Education program. Normally, six credits will be given for EL Ed 696 (Master's Creative Project). All MEd students will complete Educ 696 (Research for Classroom Teachers, 3 credits) and other courses listed on the current Program of Studies form. A committee chair and two committee members will work with students completing the creative project; however, the chairperson will have major responsibility in approving the proposal and primarily work as the program adviser with the committee members being involved more directly in the presentation of the creative project (oral exam).

**Master of Arts/Master of Science.** Plan A. Students planning to pursue a future doctoral degree or wishing to follow a traditional master's degree should complete a Master of Arts or Master of Science Plan A degree. This is

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1 Taught on demand.
2 Registration for ECE 603 or 793 requires prior approval (by the major professor and the department head) of a written proposal by the student for the coursework to be performed.

*Taught 1985-96.
**Taught 1990-97.
® Repeatable for credit. Check with major department for limitations on number of credits that can be counted for graduation.
a 48 credit program, including 9 credits for the thesis. Educ 667 is required as a research course (rather than Educ 666). A copy of other required core and professional option courses is available from the department office. A committee chair and two committee members will work with students pursuing the Plan A master's degree. Plan A students should submit an Appointment for Examination form to their major professor, committee, and the Graduate School at least five working days before the final examination is to be held.

Plan C. In order to provide another option for elementary education master's degree students, the Department of Elementary Education conducts a Plan C option within its Master of Science degree. The basic elements of a Plan C option include completion of 80 credits of prior approved graduate coursework, completion of a directed culminating project, and a presentation and defense of the project.

The culminating project should be a pre-planned scholarly activity. It could be a paper discussing coursework applicability to the student's teaching assignment, or a written plan for changing curriculum and/or instruction drawing on coursework and the student's role, etc. The intent is that a project be an integral part of the planned course of study and the student's assignment.

Educ 667 or 666 (Research, 3 credits) is required; however, thesis credits are not taken or accepted. A notice of intent to graduate is to be completed by the student, approved by the committee chairperson (program adviser), and filed with the School of Graduate Studies at the beginning of the quarter the student plans to finish the degree.

Additional Information. The master's degrees must be completed within a six-year time limit. Pass/fail grades will be accepted only for seminar, special problems, interdisciplinary workshops, thesis or dissertation research, and continuing graduate advisement. A maximum of 12 workshop credits may be included. Transfer credit accepted toward the degree is normally limited to 9 credits; however, with prior approval, 18 transfer credits may be accepted. A maximum of 15 credits taken during one summer may be counted toward the degree.

Requirements for the Master of Arts degree include two years (approximately 25 credits) of an acceptable foreign language or the equivalent, as determined by testing arranged by the supervisory committee and approved by the department and the graduate dean. One year each, or the equivalent, of two languages is acceptable if approved by the student's committee.

All students completing master's degrees in elementary education must enroll for a minimum of 15 credits on the USU campus (except students completing their degrees at one of the USU Residence Centers: Southeastern Utah Center,Uintah Basin Center, Combined USU/SUU Master's Program).

The Program of Studies form for the appropriate degree and plan described above should be approved by the committee and submitted to the School of Graduate Studies at least two months prior to the final exam, final meeting, or presentation appropriate to that degree.

Doctoral Programs (PhD and EdD). The department participates in the Interdepartmental Doctoral Program in Education, Doctor of Philosophy (PhD) and Doctor of Education (EdD). For information about areas of specialization, emphases of study, research sponsored, admission requirements, procedures to follow, and other information, see pages 35-37 of this catalog.

Research

Cooperation with other departments and research centers at the University and with public school and State Office of Education collaborators permits strong graduate programs in all phases of elementary education. Opportunities for research with the Edith Bowen Laboratory School and with cooperating school districts in Utah and surrounding states, the Utah State Office of Education, and the United States Department of Education are available.

Financial Assistance

Both departmental and School of Graduate Studies support are available for the regular academic program and are awarded on a competitive basis. Students requesting financial support should apply to the department by March 15. To be eligible for financial assistance, a student must attend USU full-time. No financial assistance is available for summer quarter.

Assistantships. Teaching assistantships are available through the department. Some research assistantships are available through faculty members who have ongoing projects with off-campus funding agencies.

Students are not eligible for assistantships or any form of financial assistance from the University until all application procedures are completed and the student is formally admitted to a program of studies.

Acceptance to pursue graduate study does not guarantee the student financial assistance. Inasmuch as funds are limited, the assistantships are awarded by the department to cover specific teaching assignments and by the faculty to provide for research.

Doctoral students desiring information about financial assistance should contact the Coordinator, Doctoral Degrees, College of Education, Utah State University, 84322-2805.

Career Opportunities

Positions in Higher Education—Master Teachers. Many school districts support and encourage teachers to further their education and expertise by obtaining the master's degree. Added financial remuneration generally accompanies the completion of such a degree. Supervisors, curriculum specialists, and other professional careers are enhanced by completion of the master's degree.

Completion of the doctorate offers a wide variety of careers, including positions in higher education, as curriculum specialists in school districts and state offices of education, in education agencies of the United States government, and as education specialists in business and industry.

Elementary Education Courses

600 (d500). Managing Student Behavior. Provides educators with theory and application of basic principles for responsible student behavior in school. (3)

602. Practicum in Improving School System Programs. A field-based program focusing upon characteristics of effective teaching methodologies, teaching performance, curriculum decision making, value guidelines, and the characteristics of the learner. (1-6)
604. Measurement and Evaluation in Education. Principles and techniques for developing, validating, and interpreting tests of student achievement of learning goals. (3)


620. Improvement of Early Childhood Education. Students will examine current issues and research topics in early childhood education that are important to the improvement of K-5 programs. (3)

621. Workshop in Childhood Education. Exploration of current topics in childhood education. (1-3)

622. Workshop in Early Childhood Education. Exploration of current topics important in the teaching of young children. (1-6)

623. Early Childhood Methods and Curriculum. Advanced course in early childhood education, addressing developmentally appropriate curriculum for teaching young children. (3)

624. Workshop in Science Education. Exploration of current topics in science education. (1-6)

625. Graduate Cooperative Work Experience. A cooperative education work experience at a professional level. Prior approval required. (1-15)

626. Supervised Practicum in Early Childhood Education. Candidates will, through a supervised practicum field experience, demonstrate their ability to apply and integrate early childhood theory and research into effective practice. (3)

630. Workshop in Mathematics Education. Exploration of current topics and methods in mathematics education. (1-3)

631. Supervision and Administration Internship. Provides experience in supervision and administration in school systems. (3)

634. Issues in Teaching of Reading. Exploration of current approaches and recent topics in the teaching of reading. Emphasis is on developmental aspects of reading, present practices, and implications of research in reading. (1-9)

635. Diagnosis of Reading. For teachers, supervisors, and other interested school personnel in remedial reading instruction. Concerned with causes of reading deficiencies, diagnostic tests, and procedures used in remedial reading. Prerequisite: EI Ed 310 or two years of successful teaching experience in the elementary school. (3)

636. Remedial Reading Instruction. Designed to follow EI Ed 635. Considers the nature of remedial reading instruction, practices in selection of remedial students, group and individual instruction, and methods and materials used in remedial reading programs. (3)

637. Practicum in Remedial Reading. Designed to follow 635 and 636. Provides opportunity for the students to work with children in need of remedial help in reading. Enrollment only with consent of the instructor. (3)

640. Current Problems in Elementary Education. Considers those areas of elementary curriculum in which members of the class desire current, authoritative points of view. Opportunity for both individual and group work (3)

644. Creative Education. Exploration of research concerning creativity in education relating to teaching processes and attitudes for utilizing basic principles in the improvement of classroom practices. (3)

646. Education of the Gifted and Talented. Designed to provide educators with background and skill in working with gifted and talented students. Examines multiple types of learning and thinking talents and gifts. (3)

647. Identification and Evaluation in Gifted Education. Designed to provide educators with background and techniques for identifying gifted, talented, and creative students. Examines multiple evaluation models, experience in identification and evaluation. (3)

648. Materials and Methods in Gifted Education. Explores curriculum theories and techniques in gifted and talented education with special attention to the development of instructional materials for use with students. (3)

649. Supervised Practicum in Gifted Education. A practicum experience designed to bring students into contact with a variety of education situations that will prepare them for their anticipated professional role in gifted and talented education. May be completed in public schools, or at the Edith Bowen Laboratory School, or at the State Office of Education. (3-6)

650. Interdisciplinary Workshop. (1-3)

655. Practicum in the Evaluation of Instruction. A field-based research study contributing toward graduate degrees and supervisory certification related to the assessment of an ongoing or newly proposed program of instruction. (1-6)

656. Practicum in Improvement of Instruction. A field-based program focusing upon characteristics of effective teaching methodologies, teaching performance, curriculum decision making, value guidelines, and the characteristics of the learner. (1-6)

661. Topics in Middle Level Education. Designed for teachers in grades 5-9. Focuses on topics specific to teaching young adolescent students. A few of the topics which can be selected are: understanding the learner; designing a child-sensitive, interdisciplinary curriculum; democratic approaches to classroom management; and age appropriate instruction. (3W,Su)

665. Improvement of Reading Instruction. Emphasizes components of an adequate developmental reading program, with emphasis upon procedures for helping the child who is having general reading difficulties. Prerequisite: EI Ed 310, 404, or teaching experience in elementary or middle school. (3)

670. Improvement of Science Instruction. For experienced teachers. Considers new concepts in curriculum and methods of instruction in science in the elementary schools. Prerequisite: EI Ed 401 or teaching experience in elementary or middle school. (3)

671. Multicultural Education. Examines the social and cultural conditions that influence education. Places emphasis on program development to meet needs of culturally diverse school population. (3)

675. Improvement of Mathematics Instruction. For experienced teachers. Considers new concepts in curriculum and methods of teaching mathematics in the elementary or middle school. Prerequisite: EI Ed 405 or teaching experience in elementary or middle school. (3)

680. Improvement of Social Studies Instruction. For experienced teachers. Emphasis placed upon study of newer concepts in curriculum and methods of instruction of the elementary social studies programs. Prerequisite: EI Ed 405 or teaching experience in elementary or middle school. (3)

685. Improvement of Language Arts Instruction. For experienced teachers. Examination of new research in linguistics and processes of teaching the language arts program in the elementary school. Prerequisite: EI Ed 403 or teaching experience in elementary or middle school. (3)

690. Independent Study. (1-3)

691. Independent Research. (1-3)

696. Master's Project. This experience provides students with opportunity to design and carry out a creative project which is closely related to his or her area of teaching specialty. Requires a written report. (3-6)

697. Thesis. (Master's level) Research and thesis writing with guidance and criticism. (1-12)

699. Continuing Graduate Advisement. (1-12)

702. History and Philosophy of Early Childhood. A survey class designed to assist early childhood professionals to become acquainted with the historical and philosophical framework on which educational programs are based. (3)

705. Internship in Program Evaluation. Experience in practical aspects of program evaluation through planned, supervised evaluation project participation approved by the student's supervisory committee. (1-6)

706. Internship in Research. Experience in conducting research through planned, supervised research project participation approved by the student's supervisory committee. (1-6)

712. Student Teaching Supervision. Considers ways and means of providing desirable experiences for student teachers in the public schools. The role of the classroom teacher and the college supervisor will be analyzed. (1-6)

723. Supervision Internship. Provides extensive supervisory experience for doctoral students. Internship is for a period of time to be specified by the department and cooperating agency. (3-12)
Department of

English
College of Humanities, Arts and Social Sciences

Head: Professor Jeffrey Smitten, British literature, criticism
Office in Ray B. West 201, 797-2733

Assistant Head: Professor Christine Hult, composition and rhetoric
Office in Ray B. West 201B, 797-2735

Director of Graduate Studies: Professor Kenneth W. Brewer, poetry, essay
Office in Ray B. West 310, 797-3516

American Studies Adviser: Professor Barre Toelken, folklore
Office in Ray B. West 304, 797-2734

Professors Jay Anderson, folklife, material culture, folk art; Jan Bakker, American literature; Joyce A. Kinkead, composition; Thomas J. Lyon, Western American literature; Willis L. Pitkin, Jr., composition; Reed C. Stock, British literature; Associate Professors Theodore Andra, British literature; Kate M. Begnal, twentieth century literature; Patricia Gardner, literature, folklore; Sonia Manuel-Dupont, linguistics; Thomas S. Romano, English education; Jan E. Roush, American Studies, folklore, composition, and rhetoric; John A. Scherting, American Studies, American literature; Anne Shiffrer, literary theory, literature; Ronald R. Shook, composition and rhetoric; Steven Siporin, folklore; Assistant Professors Bishnupriya Ghosh, British and commonwealth literature; Keith A. Grant-Davie, composition and rhetoric; David E. Hailey, Jr., technical writing; John E. McLaughlin, linguistics, technical writing; Lynn L. Meeks, teacher education; Roberta S. Stearnman, American literature, fiction

Degrees offered: Master of Arts (MA) and Master of Science (MS) in English and in American Studies

Specializations: English—British and Commonwealth Studies, Literary Studies, Technical Writing, Theory and Practice of Writing; American Studies—Folklore, Public Sector Folklore, Standard Program

Admission Requirements

In addition to the requirements specified on pages 25-26 (Admission Procedures), applicants for admission to the English Department graduate programs should have a BA or BS degree with an undergraduate major in a subject area relevant to the graduate program they desire to enter. The English Department accepts the Miller Analogies Test in place of the GRE general test but encourages applicants to take the GRE. In some cases, professional experience may be considered in lieu of the academic major or minor.

International applicants from non-English-speaking countries who desire an MA or MS degree in English should have a BA or BS degree in English from an accredited, English-speaking university. International students applying to the American Studies program whose command of written English is not adequate to the demands of writing a graduate thesis in English may be required to take courses in Intensive English or be counselled to obtain a second bachelor’s degree at USU (45 credits minimum).

Applications will be held until February 15, at which time the review committees for each program will make the first selection of applicants for the following fall quarter. Also at this time, selections will be made for teaching assistantships and other financial aid.

A final selection of applicants will be made on June 1. If programs are not full at that time, other applications might be considered on a “space-available basis” only.

735. Internship in Curriculum Development. Internship with recognized leaders in the development, implementation, and evaluation of curricular programs and activities at early childhood, elementary, and/or middle education levels. (1-6)®

750. Interdisciplinary Workshop. (1-3)®

755. Evaluation of Supervisory Performance. A program for graduate students to become acquainted with and demonstrate competency in supervision. (1-6)

781. Research Seminar. Identification of research problem, consideration of research strategies and methods, application of research and statistical concepts in departmental focus, and interaction with faculty. (1)®

790. Independent Study. (1-3)®

791. Independent Research. (1-3)®

797. Dissertation. Individual work on research problems in the PhD or EdD program. Emphasis placed upon writing and editorial techniques. (1-12)®

799. Continuing Graduate Advisement. (1-12)®

® Repeatable for credit. Check with major department for limitations on number of credits that can be counted for graduation.

1 Students should request from the department an annual listing of courses to be offered each quarter for each academic year.

2 Parenthetical numbers preceded by d indicate a dual listing.
Students who have not been accepted into a graduate program in the English Department must have permission from the departmental director of graduate studies to enroll in English graduate courses.

Degree Programs

The Department of English offers courses of study leading to the MA and MS degrees in English and in American Studies. Students seeking an English degree may be admitted into the British and Commonwealth Studies program, the Literary Studies program, the Technical Writing Program, or the Theory and Practice of Writing program (with emphasis on composition philosophies and applications). The degree in American Studies is interdisciplinary and may include almost any combination of courses dealing with American culture: history, literature, art, government, business, etc. Folklore is one of the major subject areas within American Studies, with courses in all aspects of folklore study, including public sector.

In either English or American Studies three options are available. Plan A requires at least 45 credits, 9 of which must be for an approved thesis. Plan B requires 48 credits, but only 3 credits of research thesis and 45 credits of class work. Plan C requires 54 credits of coursework, but no thesis. For all options, classes are to be at the 600 level, except for 500-level work approved by the director of graduate studies.

Course Requirements

All candidates for the MA must present a two-year level of competency in a foreign language. In most cases the language requirement for a BA degree will satisfy the requirement.

Only grades of B- or better will be accepted for credit in support of the degree programs; however, students must maintain an overall GPA of 3.0 to remain in the program.

All candidates must take a comprehensive examination covering the material of their graduate programs and administered by the director of graduate studies. Part of the focus of the final oral exam will be on the thesis or the Plan B papers/project.

All candidates must successfully complete English 600 or the program equivalent during the first four quarters of study at USU. Failure to do so will place a candidate in nonmatriculated status at the end of the fourth quarter.

All candidates who are first-year graduate teaching assistants are required to take Eng! 692. It is up to the student's graduate committee whether Eng! 692 will be accepted as part of the student's graduate program.

Those who have been admitted to either the British and Commonwealth Studies specialization or the Literary Studies specialization will design their course of study under the guidance of the director of graduate studies and their supervisory committee.

Those who have been admitted to the Theory and Practice of Writing specialization will also design their course of study under the guidance of the director of graduate studies and their supervisory committee. Most of their courses will be in theory of writing and writing; however, they should also take a minimum of 6 credits in literature. Those who choose the Technical Writing specialization must complete 48 credits in a Plan B program, and will develop a portfolio instead of a thesis.

Those who have been admitted to the American Studies degree program will work out a program of study with the American Studies adviser. The emphasis in graduate work will be largely governed by (1) the student's cultural and professional objectives and (2) undergraduate coursework. Generally students develop their programs with an emphasis in American literature, folklore, or history. Interdisciplinary connections with nearly every department at USU are possible.

Students may choose to focus on any of the particular specialization areas offered by the faculty of the program:

A. Standard Program. A combination of currently offered courses in American literature, plus related courses in folklore, anthropology, and American history.

B. Folklore. Graduate courses in folklore genres, theory, themes, folk groups, fieldwork, archiving, and anthropology.

C. Public Sector Folklore. Graduate courses in folklore, fieldwork, public sector history and issues, plus electives in practical areas (journalism, photography, and instructional technology).

All Plan A students write a thesis (9 credits of English 697). Plan B students in English must write two seminar papers or their equivalent with thesis standards and file them with the English Department. Plan B students in American Studies may substitute a project for a paper, depending on the area of emphasis and with the approval of the appropriate graduate committee.

Candidates may enroll in 500-level courses if the following conditions are met: (1) they have received approval from the director of graduate studies, and (2) corresponding 600-level courses do not exist or will not be offered during residency at USU. To earn graduate credit in a 500-level course, candidates must do additional, graduate-level work in the class.

Candidates will meet with the director of graduate studies or the American Studies adviser to decide upon a major professor and a committee after the successful completion of Engl 600 and approval of the Plan A or Plan B option. The head of the department and the dean of the School of Graduate Studies must approve the membership of the candidate's committee.

Financial Assistance

The Department of English has a limited number of teaching assistantships and scholarships available on a competitive basis for both English and American Studies graduate students. Those interested in applying for departmental financial aid should write to Dr. Kenneth W. Brewer, Director of Graduate Studies, Department of English, Utah State University, Logan, UT 84322-3200. Although the Department of English does not require GRE scores for admission into the graduate program, those who are interested in other sources of financial aid should complete the general GRE exam since the University awards major scholarships on a competitive basis to students with high GRE scores.

Admission to an English Department graduate program does not guarantee financial assistance.
English Courses

600. Bibliography and Research Methods. Required of all candidates for the master's degree in English. (3)

602. Advanced Fiction Writing. Advanced practice in writing fiction. (3)

604. Advanced Essay Writing. Developing sophisticated skills for writing the publishable essay. (3)

605. Rhetoric and Basic Writing. Current basic writing theories and practical strategies. (3)

606. Advanced Poetry Writing. Advanced practice in writing poetry. (3)

607. Creative Writing in the Classroom. Writing/methods course surveying approaches and assignments necessary for teaching creative writing to elementary, middle, and secondary students. (3)

608. Topics in Technical Writing. Technical writing course covering special topics. Designing manuals, report formats, specifications, and technical styles included. (3)

611. Discourse: Analysis and Synthesis. Defines the discourse code, detailing its relationship to other language codes and preparing students to evaluate and improve writing curricula and pedagogy. (3)

612. Discourse Analysis. Theoretical issues associated with their study. (3)

613. Topics in Writing and Rhetoric. Intensive study of current trends in writing and rhetoric. (2-3)

616. Advanced English Methods. (3)

617. Modern Composition Theory. (3)

618. History of Rhetoric to 1900. (3)

620. Introduction to Literary and Cultural Studies. Introduction to literary theory and the concept of cultural studies. (3F,W,Sp,Su)

621. Literary Criticism. A survey of the major methods and philosophies of literary criticism. (3F,W,Sp,Su)

622. Folk Narrative. Principal genres of folk narrative (Marchen, tales, legends, folk histories, ballads, etc.) and the theoretical issues associated with their study. (3F,W,Sp,Su)

624. Regional Folklore. Folklore of a specific region, identified each quarter taught. (3)

625. Graduate Internship/Cooperative Work Experience. Professional level of educational work experience in an internship/cooperative education position for graduate students. (1-15)


627. American Authors. Study of a single writer or a very small group of writers from the United States. (3F,W,Sp,Su)


629. Themes in American Literature. Study of a single theme in the literature of the United States. (3F,W,Sp,Su)

630. Periods in British Literature. Studies in a major period in the literary history of the British Isles, the Commonwealth, and/or the postcolonial nations. (3F,W,Sp,Su)

631. British Authors. Study of a single writer or a very small group of writers from the British Isles, the Commonwealth, and/or the postcolonial nations. (3F,W,Sp,Su)

632. Genres of British Literature. Study of a single genre in the literature of the British Isles, the Commonwealth, and/or the postcolonial nations. (3F,W,Sp,Su)

633. Themes in British Literature. Study of a single theme in the literature of the British Isles, the Commonwealth, and/or the postcolonial nations. (3F,W,Sp,Su)

636. Regionality in Literature. Studies in the literature of a specific region or regions, emphasizing the local elements shaping that literature. (3F,W,Sp,Su)

637. Race, Class, Gender, and Religion in Literature. Studies in the literary representation of the major forces of social divisions. (3F,W,Sp,Su)

638. Film and Popular Culture. Studies of the role of film and popular culture in American culture and/or the culture of the British Isles, the Commonwealth, and the postcolonial nations. (3F,W,Sp,Su)

646. Folk Groups and Folklore Genres. Survey of folk groups and folklore genres. Taught during Folklore Conference only. (3Su)

657. American Studies Internship in Mountain West Culture. Internships will be available at local or regional sites where interns will gain practical experience in museology, archive management, or historical farm development and operation. (2-13)

669. Themes in Folklore. Leading themes in folklore study as applied to the interpretation of cultural, social, and historical phenomena. Folklore as related to one of the following: gender, family, ethnicity, religion, history, politics, etc. Graduate standing required. (3F,W,Sp,Su)

672. Folklore Colloquium. Issues, problems, and methodologies in folklore study. (3)

673. Studies in Folklore. Study and interpretation of material culture (folk art, vernacular architecture, vernacular tools, etc.) and customary expressions of everyday life (customs, festivals, foodways, etc.). Theoretical analysis of these genres; museum and living-museum exhibits and interpretations. (3F,W,Sp,Su)

674. Outdoor Museum Planning and Administration. Introduction to planning and evaluation of folklore museums. Topics covered include mission statement, objectives, collecting and conservation policy, educational and interpretive programs, and physical development. (3)

675. Outdoor Museum Research and Conservation. Seminar on particular research and curatorial needs of folklore museums. Emphasis on documentation of material culture, selection of interpretive themes, and development of materials for interpretive programs. (3)

676. Outdoor Museum Interpretation and Educational Programming. Seminar on interpretive programs at folklife museums. Focus on living history, the use of historical simulation to recreate the everyday lives of ordinary people. (3)

677. History Museum Internship. Directed internship at a regional indoor or outdoor history museum or participation in a historical research or interpretive project at a cultural institution, for example, a state park, national forest, historic site, or folk-life festival. (6-12)

678. Scholarly Editing Internship. Training in the requirements of editorial work in scholarly journals and books. Emphasis is placed on editing technique and the mechanics of editorial work. (2-6)

679. Folklore Fieldwork. Introduces advanced student to problems and techniques of fieldwork, including making sound recordings of orally transmitted expressions, photographs of material traditions, and descriptions of problematic genres. Technical training, ethics, field exercises, analysis, plus perspectives on archiving and publication of results. (3)

692. Practicum in Writing Instruction. Required of first year teaching assistants; emphasis on teaching college composition. (1-3)

693. The Teaching of English. Taught as a summer workshop only. (3)

695. Independent Study. (1-5)

697. Thesis. (1-10)

699. Continuing Graduate Advisement. (1-3)

(Repeatable for credit. Check with major department for limitations on number of credits that can be counted for graduation.)
Department of
Family and Human Development
College of Family Life

Head: Professor Jay D. Schwaneveldt, marriage and family studies, family life education, international families, theory and methods
Office in Family Life 211, 797-1501

Professors Ann M. Berghout Austin, alternative child care and family life, development from birth to 12 years of age; Glen O. Jenson, rural family, in-law and grandparent role performance, family life education, work/family challenges, family issue identification; Thomas R. Lee, parenting, family life education, family resiliency; Brent C. Miller, adolescent pregnancy, parent-child relations, research methods, marriage and family studies; Adjunct Professors Fran R. Ascione, prosocial development, moral development, developmental psychopathology; Deborah A. Byrnes, multi-age classrooms, teachers' attitudes towards students with English as a second language, social studies education; Professor Emeritus C. Jay Skidmore, family therapy, family life education; Associate Professors Randall M. Jones, adolescent development, identity, problem behavior, prevention, research methods; Shelley L. Knudsen Lindauer, alternative child care, gender role development, early childhood education, curriculum administration, socialization, development in infancy and early childhood; Thorana S. Nelson, marriage and family therapy, gender, family therapy training and supervision; D. Kim Openshaw, marriage and family therapy, research and application, typological and intervention strategy advancement of youthful sexual offending, theoretical conceptualization of self-esteem, martial arts and mental health related syndromes; Lori A. Roggman, infant social development, attachment, parenting stress, play across the life span, physical attractiveness, early intervention; Adjunct Associate Professor Sarah Rule, methods of early intervention, applications of technology to staff development, improvement of service delivery systems; Assistant Professor Scot M. Allgood, family therapy process, assessment, and marital studies; Adjunct Assistant Professor Glenna C. Boyce, marriage and family, human growth and development, guidance of children; Lecturers Deborah B. Ascione, marriage, human development, child abuse and neglect; Farol Ann G. Nelson, early childhood education, child development, parent education, experiences in the arts for early childhood; Adjunct Lecturer Larry E. Jones, family and domestic law; Adjunct Clinical Lecturers Guena Couillard, marriage and family therapy; Victor H. Nelson, marriage and family therapy, gender issues; T. Brent Price, marriage and family therapy

Degrees offered: Master of Science (MS) in Family and Human Development, specialization in Family and Human Development in the Family Life Doctor of Philosophy (PhD)

Specializations: MS only—Adolescence and Youth, Infancy and Childhood, Marriage and Family Relationships, Marriage and Family Therapy

Admission Requirements

See general admission requirements on pages 25-26. Students may use either the GRE or MAT for application for all specializations in the MS degree, except for the Marriage and Family Therapy (MFT) specialization where GRE scores are required. The GRE is required for the PhD program. Additional assessment is required for admission to the MS marriage and family therapy emphasis. The MAT score and the GRE verbal and quantitative scores should be at or above the 40th percentile.

MS in Family and Human Development; PhD Specialization in Family and Human Development

Graduate students receive a strong research and theoretical base in family relationships and human development. In addition to the core courses required for each of the specializations, students have the opportunity to achieve their program goals with a wide range of other graduate courses in the department as well as designated courses in related programs at USU. Graduate students are also expected to engage in independent study, practica, and other specialized professional experiences that help them to acquire specific skills.

Students in the MS program complete a research thesis that makes a contribution to knowledge in family studies or human development.

All students in the MS marriage and family therapy emphasis also complete required clinical experiences. The MS marriage and family therapy emphasis satisfies basic educational requirements for Utah State licensure in marriage and family therapy and clinical membership in AAMFT. The marriage and family therapy emphasis is recognized as a candidate program by the Commission on Accreditation for Marriage and Family Therapy Education.

Students in the PhD specialization complete a major research dissertation that makes a significant contribution to the theoretical and empirical knowledge in family studies and human development.

The department provides advanced graduate education and training for students to (1) establish the professional competency necessary for employment in research, teaching, marriage and family therapy, extension, and administration; (2) develop skills necessary for agency administration in the field of family and child care services; (3) receive clinical practice in marriage and family therapy; and (4) develop the skills for supervisory responsibilities in child development laboratories, child-care facilities, and adolescent programs.
Core Courses

The core substantive courses for the master's degree are FHD 601, 606, 610, and 670. For the PhD, students must complete FHD 701, 706, 710, 725, 770, and 775. Students may enroll for more than 3 credits of FHD 725 and 775.

Research

The department has three major child development laboratories, an adolescent lab, research labs, and marriage and family therapy training facilities that are available for research and training in the graduate program. In addition, the department enjoys a long history of research activities with preschools, public schools, extension programs, and other agencies in various counties throughout the state.

Career Opportunities

Recent recipients of advanced degrees have found employment in schools, academic departments at various universities, hospitals, Head Start, child-care programs, social services, mental health agencies, private and clinical practice settings, extension services, and related agencies serving families and children.

Financial Assistance

Extensive teaching, research, and extension graduate assistantships are available for applicants for both the MS and PhD degrees. Attractive fellowships are available for strong PhD students. When an applicant's folder is complete, it is reviewed by the Graduate Admissions and Finance Committee. This committee makes specific recommendations regarding admission and financial support. Assistantships and fellowships typically include waivers for out-of-state tuition. Most students pay the regular in-state tuition. A limited number of tuition waivers are available for qualified students.

Family and Human Development Courses

550. Interdisciplinary Workshop. (1-3F, W, Sp, Su) (3)

565. Parenting and Family Life Education. Methods and theories in family life education, applied to current parenting issues. (3)

601. Socialization is Human Development. A variety of contemporary socialization experiences are examined from an empirical developmental perspective. Personality-social development is highlighted from a social-historical and social change framework. (3W)

606. Theories of Human Development. Assessment of major developmental theories, contributions from philosophical, personality and learning theories, epistemology, and ethology, as they relate to human development. Prerequisite: FHD 150 or equivalent. (3F)

610. Seminar in Family Relations. Overview and assessment of significant areas of research in marriage and the family. (3F)

625. Graduate Internship. Developmental guidance of students in the direct application of family and human development skills and knowledge in a setting supervised by a family and human development professional. One credit for each 40 hours of experience. (1-12F, W, Sp, Su)

629. Survey of Marriage and Family Therapy Theories and Practice. Introduces master's students to the profession and practice of marriage and family therapy. Through readings of theory, discussion, role play, and interviews with nonclinical families, students learn basic theory and skills essential to a family therapy. Instructor's permission required. (3F)

630. Family Therapy Theories I. Theories of family therapy including foundations of systems thinking, Milan, and Transgenerational theories. (4F)

631. Family Therapy Theories II. Advanced study of theoretical, practical, and research tenets of several of the foundational theories of family therapy: Behavioral (and integrated models such as cognitive behavioral), Functional, and Experiential. (4Sp)

632. Family Therapy Theories III. Advanced study of theoretical, practical, and research tenets of several of the foundational theories of family therapy: Strategic, Solution-focused, and Narrative. (4Sp)

637. Ethics and Professional Issues in Human Development, Family Relations, and Family Therapy. Issues of ethics and professional socialization in family therapy, including credentials, practice settings, legal issues, interprofessional relations, and accountability. (4W)

638. Analysis and Treatment of Human Sexual Dysfunction and Dissatisfaction. Assessment and treatment of human sexual dysfunction from a family therapy perspective. (4F)

639. Assessment in Marital and Family Therapy. Family therapy assessment models including individual assessment tools used in family therapy. (4W)

641. Social Change and the Family. Effects of social change on rural and urban families, and the impetus for these changes. Coping with change in terms of marital, family, and parenting relationships. (3Sp)

650. Family-child Interaction. Family interaction processes related to child development and behavior. Reciprocity of parent-child relationships. (3Sp)

654. Moral Development in the Family. In the context of family and human development, empirical and interdisciplinary information is presented in the areas of emotional, cognitive, and interactional aspects of morality. (3Sp)

662. Using and Interpreting SPSS to Analyze Social Research Data. Use of SPSS for descriptive statistics, contingency table, ANOVA models, and multiple regression. Syntax, procedure options, and interpretation of output. Prerequisite: Statistics course. See instructor before enrolling. (3F, Sp)


675. Research Topics in Family and Human Development. An in-depth analytic review of current or special topics associated with faculty research programs. (1-3F, W, Sp, Su) (3)

677. Aging and the Family. Aging across the life cycle in the family, care for family members in society, and generational relationships. (3Sp)

680. Research Methods. Techniques and tactics in designing and analyzing social science, family, and human development research; emphasis on designs and instrumentation. Prospectus required. Prerequisite: undergraduate methods or research experience recommended. (3Sp)

681. Methodological Designs in the Study of Change. Current issues in family and human development research are reviewed and critically analyzed for students interested in research associated with multivariate cross-sectional and longitudinal research interests. Prerequisite: FHD 680 or equivalent. (3W)

683. Personality and Social Development in Adolescence. Several basic patterns of development in personality and social growth during adolescence are examined. Focus on patterns of growth, potential and real contributing factors to growth, and assessment issues. (3Sp)

684. Family and Peer Relations During Adolescence. The major changes and transformations that occur in family and peer relationships during adolescence are examined. Focus on the study of family transformation, family contributions to development, and issues of assessment in family and peer relations. (3Sp)

685. Family Health and Social Problems During Adolescence. In a seminar format, several family and social health problems are examined from a family systems or family process perspective. (3Sp)

686. Infancy. In seminar format, research and issues related to various facets of development from birth to two years, are examined at both individual and contextual levels. (3F)

687. The Preschool Child. Critical assessment of developmental issues in children two to five; focus on social, emotional, cognitive, linguistic, perceptual, and physical areas. (3W)

688. Middle Childhood. Children's development in physical, motor, social, emotional, linguistic, and cognitive areas from ages 6 to 12; focused on methodological, theoretical, and social policy issues. (3Sp)

692. Practicum in Marriage and Family Therapy. (1-6F,W,Sp,Su) ©


699. Continuing Graduate Advisement. (1-3F,W,Sp,Su) ©

701. Research Seminar in Human Development. Critical review and evaluation of research in the study of human development. (3W)

706. Theoretical Frontiers in Human Development. Identification, status, and application of theories and theory development in human development. (3Sp)

710. Research Seminar in Family Relations. Critical review and evaluation of research in the study of marriage and family relationships. (3W)

725. Advanced Graduate Internship. Professional supervision of doctoral students applying and interpreting the general principles from the study of and research in family and human development. (1-9F,W,Sp,Su) ©

762. Special Topics in SPSS Programming for Family Studies and Human Development. Training in and usage of SPSS and/or SAS programs for research in FHD. Prerequisite: Stat 560 or 601. (3W)

770. Theoretical Frontiers in Family Relations. Identification, status, and application of theories and theory development in marriage and family relationships. (3Sp)

775. Advanced Topics in Family and Human Development. Major topics and issues in the study of family and human development. (3F,W,Sp,Su) ©

790. Independent Study. Prerequisite: instructor's permission. (1-9F,W,Sp,Su) ©


799. Continuing Graduate Advisement. (1-3F,W,Sp,In) ©

1Not all courses are offered each year. Check with the department for current offerings.

© Repeatable for credit. Check with major department for limitations on number of credits that can be counted for graduation.

Department of

Fisheries and Wildlife

College of Natural Resources

Head: Professor Raymond D. Dueser, wildlife ecology
Office in Natural Resources 206, 707-2459

Professors Gary E. Belovsky, conservation and population ecology; John A. Bissonette, leader, Utah Cooperative Fisheries and Wildlife Research Unit, population ecology, behavioral ecology of ungulates; Joseph A. Chapman, Dean of College of Natural Resources, mammalian biology and ecology; Charles P. Hawkins, stream ecology; John A. Kadlec, assistant dean, College of Natural Resources, wetlands ecology, waterfowl; Frederic H. Wagner, associate dean, College of Natural Resources, ecology and management of animal populations; Michael L. Wolfe, ungulate ecology and management; Professors Emeriti Jessop B. Low, waterfowl management; John M. Neuhold, fisheries management, aquatic ecology; William F. Sigler, fisheries management; Allen W. Stokes, animal behavior; Associate Professors Michael R. Conover, wildlife management, behavior, animal damage management; Todd A. Croel, aquatic ecology, predator-prey interaction, quantitative animal ecology; Chris Luecke, fish ecology, ichthyology, limnology; Wayne A. Wurtsbaugh, limnology; Associate Professor Emeriti Gar W. Workman, fish and wildlife ecology and fish culture; Assistant Professors David A. Beauchamp, fisheries ecology and management; Thomas C. Edwards, Jr., ivian ecology, conservation ecology, biodiversity; Barrie K. Gilbert, wildlife ethology; Terry A. Messmer, wildlife extension specialist, wildlife management, wetlands ecology, waterfowl; Mark E. Ritchie, ecological energetics, wildlife behavior, ecology; Robert H. Schmidt, wildlife management, animal damage management; Research Associate Professors Martha H. Balph, animal behavior; Frederick F. Knowlton, leader, Predator Ecology and Behavior Unit, predator ecology and management; Research Assistant Professor Jeffrey L. Kershner, USDA Forest Service, national habitat coordinator, fisheries management; Adjunct Assistant Professor Ronald W. Goede, director, State of Utah Division of Wildlife Resources Experimental Hatchery, fish diseases

Degrees offered: Master of Science (MS) and Doctor of Philosophy (PhD) in Fisheries and Wildlife, in Aquatic Ecology, and in Fisheries and Wildlife Ecology

Admission Requirements

See general admission requirements, pages 25-26. Though admission to the graduate program is treated on an application-by-application basis, verbal and quantitative GRE scores at or above the 40th percentile are required with a combined verbal and quantitative score of at least 1,100. Previous training in wildlife or fisheries is not a prerequisite for admission, although a sound background in the biological sciences is recommended. Successful applicants without the necessary background in wildlife or fisheries sciences are expected to obtain it in the course of their studies for the advanced degree.

Degree Requirements

Coursework requirements are developed by the student and committee and depend on the area of specialization.

Assistantships

Research assistantships are available through individual grants or contracts. Teaching assistantships are occasionally available through the department. Recipients of teaching assistantships are usually selected from among PhD students.
Natural Resources Courses

501. Natural Resources for Teachers. Field course designed to acquaint teachers with natural resource issues, teaching methods, and materials. (2-4S/5)

576. Modeling Biological Systems. Introduction to mathematical and computer modeling of biological systems, emphasizing ecological systems. Prerequisites: Math 316 or 221, at least one upper division course in Natural Resources or Biology, Stat 201, and computer programming or permission of instructor. Three lectures, one recitation. (4F)

577. Modeling Forest Dynamics. Theory and methods of forest succession modeling. Analysis and construction of tree and forest ecosystem simulation models. Emphasis on methods and application. Prerequisites: general ecology, Math 215, Stat 301 or equivalent, CS 241, or consent of instructor. (3Sp)

601. Directed Teaching in Natural Resources. Concepts and practice in teaching natural resources at the college level. Special experiences designed for students desiring faculty positions. (1-5)

611 (d511).1 Environmental Education. Acquaint students with the nature of our natural resources, principles for intelligent stewardship, and procedures for incorporating this knowledge into learning situations. (4Sp)

643. Natural Resource and Environmental Policy Cornerstone Seminar. Introduction to interdisciplinary perspectives on natural resource and environmental policy. Goal is to help students integrate various theoretical and methodological approaches used to understand policy issues. (3Sp)

644. Natural Resource and Environmental Policy Seminar Series. Students will receive one credit for attending one year (or three quarters) of the Natural Resource and Environmental Policy Program Seminar Series. (1Sp)

645. Natural Resource and Environmental Policy Presentation. Candidates for the Interdisciplinary Certificate in Natural Resource and Environmental Policy will make a presentation on the policy dimensions of their thesis or dissertation during their last year of graduate school. One credit given for this presentation. (1Sp)

Fisheries and Wildlife Courses

510. Wildlife Damage Management Principles. Explains current legal, ethical, and biological principles for the control and/or management of problem vertebrate species. (3F)

512. Techniques in Wildlife Damage Management. Comprehensive course presenting current methods for resolving wildlife damage problems through wildlife population manipulation, behavioral exploitation, and habitat alteration. (5Sp)

514. Selected Topics in Problem Wildlife Management. Seminar course with guest speakers who are authorities in various aspects of problem wildlife management. (4Sp)

516. Methods in Biotechnology: Cell Culture. Laboratory-intensive course in basic and applied methods of culturing cells (mammalian, insect, plant) and methods of fusing and transforming cells. Prerequisites: Biol 125 or ADVS 316 or equivalent, or permission of instructor. (3W)

519. Advanced Wildlife Techniques. Field procedures for determining sex and age, habitat utilization, capture and marking, necropsy, harvest surveys, and estimating populations. Includes mapping, orienteering, and field safety. Prerequisites: FW 386, 388; Stat 201. (3F)

524. Methods in Biotechnology: Protein Purification Techniques. Laboratory-oriented course designed to provide basic knowledge in protein purification, analysis, and its scale up. Prerequisites: Chem 370 or ADVS 316, or permission of instructor. (3Sp)

525. Habitat Relationships in Managed Forests. Ecological relationships, management concepts, and policy influencing fish and wildlife habitats in managed forests. (3F)

526. Methods in Biotechnology: Molecular Cloning. Laboratory-oriented course in molecular cloning techniques such as DNA cloning, genetic probes, PCR, DNA sequencing. Prerequisites: Chem 370 or Biol 319 and Micro 301 or equivalent. ADVS 316, or permission of instructor. (5F)

527. Advanced Conservation Biology. Principles of the management of small populations, including the effects of habitat fragmentation, demography, and genetics. (1F)

530. Genetics in Conservation and Management. Principles of genetics for conservation and population management, including effective population size, stock analysis, gene flow, founder effect, and biotic diversity. (3W)

540. Ecosystem Concepts: Theory and Practice in Fisheries and Wildlife. Advanced course on the theoretical underpinnings and applications of principles of community and ecosystem ecology in terrestrial environments. Prerequisite: FW 431. (5W)

**551. Water Pollution Effects/Assessment. Review of biological and social problems associated with water pollution. Physiological effects of various toxicants on fish. Prerequisite: FW 460 or consent of instructor. (3F)

554. Principles of Fish Culture. The principles of fish culture, fish hatchery management, and nutrition of hatchery-reared fish. (3W)

555. Diseases of Fish. The common diseases of both cold and warm water fishes. Discussion of concept of diseases in fish populations. (3W)

571. Principles of Fishery Management. Study of the development and application of fishery management principles and their historic, biological, societal, economic, and institutional bases. (3W)


**580. Quantitative Analysis of Vertebrate Populations. Advanced course in wildlife and fisheries population dynamics. Introduces quantitative techniques in population estimation and prediction. (4W)

590. Case Studies in Fisheries and Wildlife. Review and discussion of case studies representing successes and failures in management of fisheries and wildlife resources. (3Sp)

601. Advanced Fisheries and Wildlife Program Administration. How to deal with nonbiological issues facing fish and wildlife resources managers at local, state, national, and international level. More comprehensive treatment of policies and administrative organizations governing wildlife resources on a global scale than FW 401. (3F)

605. Topics in Animal Behavior. Critical evaluation of current issues with emphasis on evolutionary and ecological perspectives. (1-5W)

**610. Concepts in Habitat Selection and Foraging Behavior. Provides conceptual framework from behavioral ecology and psychology for habitat selection and foraging behavior of free-living animals. Prerequisite: FW 386. (3F)

616. Animal Behavior Laboratory. Lab and field study of animal behavior, part of which will be independent study of student's choice. (2W)

620. Ecology and Management of Large Herbivores. Population dynamics, census methods, hunting regulations, and management plans. Two lectures, one lab. Prerequisite: FW 386 or equivalent. (3W)

621. Selected Topics in Fish Physiology. A directed study course of selected readings and discussions for graduate students wishing to further their awareness of fish physiology and endocrinology. (1-3F, W, Sp)

625. Graduate Internship/Co-op. Professional level of educational work experience in an internship/cooperative education position for graduate students. (1-15F, W, Sp, Su)


630. Ecology of Animal Populations. Growth, fluctuation, balance, and control of animal populations. Prerequisite: FW 386 or equivalent. (4W)

**635. Wildlife Damage Management Policy. Policies associated with wildlife damage management. Risk and needs assessment, decision-making processes, stakeholder and issue identification, and human dimension factors will be covered. (3W)

640. Waterfowl and Wetlands Seminar. Readings, discussion, and critical analysis of current research in the ecology and management of waterfowl and wetlands. May be repeated for up to 6 credits. (1-3F, W, Sp)

645. Landscape Level Patterns and Processes. Focuses on patch dynamics. Explores how disturbance of natural ecosystems results in altered patterns and changed processes. Emphasis on landscape level phenomena. (1F)
**655 (585). Production Biology in Fisheries Environments. The analysis and measurement of the production at primary, secondary, and tertiary trophic levels. Laboratory included. Prerequisites: FW 386 and 460 or consent of instructor. (4W)

**661. Stream Ecology. Structure, function, and dynamics of flowing water ecosystems. Emphasis on the ecological functioning of natural ecosystems and the effects of watershed and channel disturbance on these processes. Prerequisite: introductory courses in general ecology or permission of instructor. (3F)

675. Fish Ecology. Review of current literature on physiological, behavioral, population, and community concepts of fish interactions with their environment. Prerequisite: ichthyology, limnology, or permission of instructor. (3W)

680. Lentic and Lotic Ecosystems. Reading and discussion of current topics in freshwater ecology and management. A different topic will be discussed each quarter. Repeatable for credit. (1-2F,W,Sp)®

*681 (581). Sampling and Data Analysis for Biological Populations. Emphasis on generalized, capture-type sampling including removal models, survival estimation models, capture-recapture models, catch-effort models, catch-curve models, and change in ratio models. (4F)


687. Ecology Seminar. The Ecology Center schedules regular seminars throughout the school year with ecological scientists from other institutions participating. Ecology majors are required to attend a minimum of 10 such lectures. Register in Fall but attend through Spring. (1F)®

*690 (590). Ecology of Freshwater Wetlands. Structure, function, and dynamics of freshwater wetland ecosystems, with a view to conservation and management. Prerequisites: FW 386, Bot 420, and FW 460. (4F)

691. Directed Study. Credit for special assignments, reading, seminars beyond regularly scheduled classes. (1-5F, W, Sp, Su)®

693. Presentation and Publication in the Life Sciences. Techniques of graphic preparation, oral presentations, job interviews, grant preparation, and publication requirements in the life sciences. (3F)

695. Department Fisheries and Wildlife Graduate Seminar. Will keep students apprised on new developments in research and management in field of fisheries and wildlife. Students, faculty, and guest lecturers will participate. (1F,W,Sp)®

697. Thesis Research. Credit for field or laboratory research. (1-15F, W, Sp, Su)®

699. Continuing Graduate Advisement. (1-3F, W, Sp, Su)®

*760. Fish Population Theory. Study and discussion of the mathematical models which are in use in the field of fisheries. Four lectures, one discussion period. (5W)

762. Seminar in Animal Populations. Advanced readings, discussions, and critical analysis of population dynamics, limiting mechanisms, and theories of population regulation in animals. One class weekly. (1W)


799. Continuing Graduate Advisement. (1-3F, W, Sp, Su)®

*Taught 1995-96.
**Taught 1996-97.
® Repeatable for credit. Check with major department for limitations on number of credits that can be counted for graduation.
1Parenthetical numbers preceded by d indicate a dual listing; parenthetical numbers preceded by f are the former course numbers.
Admission Requirements

See general admission requirements on pages 25-26. Students applying for admission to the MS, MF, and PhD programs must have quantitative and verbal GRE scores at or above the 40th percentile. Foreign students must have a TOEFL score of at least 550.

Degree Programs

Master of Science. The MS is available to qualified students with bachelor's degrees. Students who do not have undergraduate forestry degrees and who wish to qualify as professional foresters must complete the undergraduate forestry core in addition to the requirements of the MS.

MS curricula may be developed to emphasize either research or managerial and administrative sciences. In a research program, the student will be responsible for a specific study leading to a thesis (Plan A). In a managerial or administrative sciences program, the coursework will be broader and the student will complete an internship or prepare a comprehensive research paper (Plan B).

The MS program consists of at least 45 credits in upper division and graduate level courses.

Core Requirements. All MS students must complete FR 681 as early in their program as possible. All graduate students must register for FR 680 every fall and spring quarter and for either FR 535, RR 780, or WS 682 every winter quarter they are in residence.

Master of Forestry. The MF has been developed to provide an opportunity for professional forestry work at an advanced level. Students entering this program must complete the forestry core requirements as well as a graduate program in one of the subject areas. This degree is accredited by the Society of American Foresters.

The MF consists of two parts: the forestry core requirement and a 45-credit graduate component.

Core Requirements. FR 320, 321, 325, 330, 420, 443, 445, 465; NR 360, 380, 390; Bot 651; and Ent 540. The graduate component consists of an additional 45 credits. At least 30 credits must be in formal courses (either upper division or graduate level) with the remaining 15 credits devoted to directed studies, seminars, problems, and formal courses. The coursework is directed toward one of the subject areas of forest biology (silviculture, genetics, ecology), forest management, outdoor recreation, or watershed science. A report is prepared on a selected problem using secondary information and relevant literature. Three special problems credits are given as part of the 45-credit requirement.

Doctor of Philosophy. The PhD is offered in Forestry, Forest Ecology, and in Recreation Resources Management. The PhD is a terminal degree and is awarded upon successful completion of a comprehensive program of coursework and original research in one of the above subject areas. It is a research degree in which the major part of the curriculum is directed toward coursework relative to the area of research

Core Requirements. All PhD students must complete FR 681 as early in their programs as possible. All stu-
dents must register for FR 780 or RR 780 fall and spring quarters and for either FR 535, RR 780, or WS 682 winter quarter every year they are in residence.

Research

Cooperation with other departments, with research centers of the University, and with government collaborators permits strong graduate programs in all phases of natural resources-related sciences. Particular mention should be made of the University's Ecology Center, in which the Forest Resources Department is very active; the Utah Agricultural Experiment Station, which has a full program in both applied and basic natural resources research; the Center for Water Resources Research, which sponsors forest watershed research; the Natural Resources Policy Center, an interdisciplinary academic program focusing on natural resources and environmental policy issues; the Institute for Outdoor Recreation and Tourism, which conducts recreation and tourism research and outreach education; and the U.S. Forest Service Intermountain Forest and Range Experiment Station, which maintains a research center on the campus for watershed research.

Financial Assistance

Both departmental and formal grant support are available to graduate students and are awarded on a competitive basis. Students requesting financial support should apply to the department by February 15.

Assistantships

Research assistantships are available through faculty members who have ongoing projects with the Utah Agricultural Experiment Station or who hold special research grants from the University, private companies, or federal agencies.

Acceptance to pursue graduate study does not guarantee the student financial assistance.

Natural Resources Courses

Natural Resources courses 501, 576, 577, 601, 611/511, 643, 644, and 645 are listed on page 99.

Forestry Courses

510. Human Dimensions of Natural Resource Management. Provides an understanding of human influences on resource use and management and methods for changing human behavior and for incorporating social values in resource management and policy decisions. (3W)

524. Principles and Practices of Intensive Silviculture. Designed to familiarize student with silvicultural methods appropriate for intensive forest management including artificial regeneration and the assessment and control of basic growth and yield relations. (4F)

534. Remote Sensing of Natural Resources. Applications of remote sensing to natural resource management; interpretation of aerial photos, satellite and radar imagery; digital analysis, vegetation and soil mapping; photogrammetry; survey techniques. (4F)

535. Forest Biology Seminar. Regularly scheduled seminar by faculty and biologists from other institutions on topics related to forest biology. (1W)

533. Natural Resource Administration. Organizational structures and processes common in natural resources administration on federal and state levels and how they impact career development and land management. (3P)

555. Environmental and Natural Resources Law and Policy. Regulation of water, air, land, and fish and wildlife resources. Federal legisla-
tion and court cases are emphasized. Current issues and state law are also considered. (2-3Sp)

*563. Forest Pathology. Nature, cause, and control of diseases affecting forest trees. Prerequisite: Bot 560 (may be concurrent). Two lectures, two labs. Also listed as Bot 563. (4W)

565. Urban Forest Management. Biological, administrative, and social aspects of managing urban forests; field exercises in inventory and planning. (4W)

566. Shade Tree Pathology. Identification, biology, and management of urban tree diseases of regional and national importance. (5W)


598. Co-op Education and Internship. Directed and evaluated graduate cooperative education or internship work experience with public or private organizations. (1-6F, W, Sp, Su)

625. Advanced Silviculture. Intensive study of a particular region by individual students. Group work consists of advanced treatment of silvics and silviculture with emphasis on physiological aspects of both subjects. (3)

628 (d327). Properties and Management of Wildland Soils. Biological, chemical, and physical properties of wildland soils; site productivity and classification of wildlands; techniques for managing wildland soils and the consequences of management. (3F)

**630. Agroforestry. Ecology and management of agroforestry systems for producing wood, fuel, food, fodder, and for the prevention and amelioration of desertification or soil degradation. (3Sp)

641. Current Issues in Multiple-use Forest Management. Advanced study within the fields of forest measurements, valuation, regulation, organization, and development of forest properties. (3W)

*642. Advanced Forest Management. Advanced study of forest-level planning on public and private lands using mathematical programming techniques. Prerequisite: FR 443 or equivalent. (3Sp)

653. Natural Resource Administration. Organizational structures and processes common in natural resources administration on federal and state level, and how they impact career development and land management. (3F)

655. Directed Studies in Urban Forestry. Independent study in urban forestry and related areas. (1-3F, W, Sp, Su)

656. Directed Studies in Forest Pathology. Independent research into forest pathosystems. (1-3F, W, Sp, Su)


665. Forest Biology. Topics pertaining to the growth of individual forest trees and the dynamics of tree populations. (3F)


671. Perturbation Ecology in Forested Systems. An investigation into the ecosystem level effects of endemic and epidemic populations of insects and diseases and of natural and man induced fire. (3Sp)

*672. Forest Biogeocchemistry. Study of inputs, cycling patterns, and outputs of major nutrients in forest ecosystems; influence of management and global environmental impacts, impact on water quality; controlling mechanisms with focus on analysis methods. Prerequisite: FR 628/627 with Micro 635 recommended. (3Sp)

680. Forest Science Seminar. (1-3)®

*681. Natural Resource Research Design. Material covers the generation of practical research hypotheses and their testing in the natural resource research context; role of ethics in environmental research. (5F)

687. Ecology Seminar. The Ecology Center schedules regular seminars throughout the school year with ecological scientists from other institutions participating. Ecology majors are required to attend a minimum of 10 such lectures. Register in Fall but attend through Spring. (1F)®

691. Directed Study. (1-6)®

697. Thesis Research. (1-10)®

699. Continuing Graduate Advisement. (1-3)®

780. Forest Science Seminar. (1-3)®

797. Dissertation Research. (1-10)®

799. Continuing Graduate Advisement. (1-3)®

Recreation Resource Management Courses

510. Outdoor Recreation Behavior. Examination of the cultural, social, and psychological influences on human behavior in a wildland recreation context and their management implications. Prerequisite: RR 390. (4F)


530. Tourism Development. Examines tourist behavior as an element in economic development and land use. Addresses characteristics of tourist regions and services in both a national and international context. (3)

598. Co-op Education and Internship. Directed and evaluated graduate cooperative education or internship work experience with public or private organizations. (1-6F, W, Sp, Su)

651. Forest Recreation. Analysis of recreation participation and programs. Functions served by participation, the constraints on participation, projection of participation levels, and the allocation of outdoor recreation resources. (3Sp)

652. Forest Recreation II. A synthesis of the institutional, spatial, and physiological factors involved in providing outdoor recreation opportunities. (3)

680. Outdoor Recreation Seminar. (1-3)®

691. Directed Study. (1-6)®

697. Thesis Research. (1-10)®

699. Continuing Graduate Advisement. (1-3)®

780. Outdoor Recreation Seminar. (1-3)®

797. Dissertation Research. (1-10)®

799. Continuing Graduate Advisement. (1-3)®

*Taught 1995-96.
**Taught 1996-97.
© Repeatable for credit. Check with major department for limitations on number of credits that can be counted for graduation.

1Parenthetical numbers preceded by d indicate a dual listing.
Department of

Geography and Earth Resources

College of Natural Resources

Head: Professor Allan Falconer, natural resources, remote sensing, geographic information systems, Africa
Office in Natural Resources 201, 797-1790

Graduate Program Coordinator: Professor Derrick J. Thom, land use, population and settlement, rural development, remote sensing, Africa

Professor Clifford B. Craig, geographic education, community development, rural planning, economic, Utah; Associate Professors Ted J. Alsop, physical, climatology, geomorphology, remote sensing, North America; R. Douglas Ramsey, remote sensing, geographic information systems, landscape ecology, spatial analysis; Assistant Professors Helen Ruth Aspaas, economic development, rural-urban linkages, women in development, cartography, Africa; Michael P. O'Neill, physical, fluvial geomorphology, quantitative analysis; John C. Schmidt, hydrology, fluvial geomorphology, mineral and water development policy; Research Assistant Professors Sharon C. Ohlhorst, environmental education, marine biology, ecology; David S. Winn, Forest Service Cooperative, wildlife biology, remote sensing, geographic information systems

Degrees offered: Master of Science (MS), Master of Arts (MA)


Admission Requirements

See general admission requirements on pages 25-26. Students applying for admission to the MS or MA program must have GRE quantitative and verbal scores at or above the 40th percentile, with a combined GRE score of at least 1,100. Foreign students must have a TOEFL score of at least 550. Previous training in geography is not a prerequisite for admission.

Degree Requirements

The MS or MA degree may be obtained with Plan A (or with Plan B by special permission), as described on pages 30-31. A graduate student handbook outlining departmental graduate program policies and procedures is available from the department.

Assistantships

Research assistantships may be available through the individual research programs of major professors. Teaching assistantships may be available through the department. All awards are made on a competitive basis and depend upon specific research and teaching needs. Admission to the graduate program of the Department of Geography and Earth Resources does not guarantee financial support.

Natural Resources Courses

Natural Resources courses 501, 576, 577, 601, 611/511, 643, 644, and 645 are listed on page 99.

Geography Courses

510. Methods of Ecological and Environmental Mapping. Introduces the concept of mapping in the field from aerial photography and from satellite data to mapping environmental regions and establishing a GIS database. (3P)

515. Fluvial Geomorphology. Broadly examines the movement of water and sediment through stream channels, the erosional and depositional processes associated with this movement, and landforms produced by these processes. Prerequisites: Students must have completed Geog/Geol 360 and Math 220, 221; or must have obtained permission of the instructor. (4Sp)

558. Geographic Methods. Designed to acquaint the student with techniques and resources utilized in geographic research. Projects requiring this methodology will be required relating to problems in Cache Valley. (3)

590. Geography Field Practicum. A course for students in geography who are involved in field research and/or internships. (1-6)

599. Readings and Conference. (1-3)®

611 (d511). Environmental Education. Acquaints students with the nature of our natural resources, principles for intelligent stewardship, and procedures for incorporating this knowledge into learning situations. (4Sp)

616 (d416). Hillslope Geomorphology. Focuses on movement and storage of sediment on hillslopes and in small channel systems. Develops an understanding of processes responsible for shaping hillslopes and examines effects of land management on those processes. Prerequisites: Geog 113, Geol 111, or WS 360. (4F)

620 (d520). Regional Geography. Analysis of the physical and cultural geography of different regions of the world. Can be repeated for different regions. (3F,W,Sp,Su)®

624 (d524). Transportation Planning. Urban and regional transportation planning process, data collection and analysis, travel demand modeling, land use, transportation interaction, computer applications. (3W)

625. Graduate Cooperative Internship. Graduate-level educational work experience in which a student is able to combine scholarly expertise with on-the-job application. (1-15)

629 (d429). Spatial Perspectives on Development. Spatial economic theory, spatial quantitative methods, and issues related to regional planning are examined in the context of developing societies. (3W)

630 (d530). Global Environments. Study of the major climatic, vegetational, and land form regions which provide the setting for global issues, such as deforestation in the tropics and acid rain. (3)

634 (d534). Aerial Photo Interpretation. Determination of location, character, and nature of objects imaged on aerial photographs. Use of precise measurements from aerial photographs for identifying, locating, and describing imaged objects. (3)
641 (d541). Synoptic Meteorology. Study and analysis of the synoptic structure of climate, with special interest in geographical distributions and practical prediction of global climates. (3W)

655 (d555). Environment, Resources, and Development Policy. Environment, natural resources, and development policy in Third World, emphasizing sustainable development. Discussion of farming systems, agropastoralism, desertification, rural health, and land use. (3F)

*666 (d465). Developing Societies. Theories and experiences of social, political, and economic development with emphasis on the problems of developing countries. (3W)

670 (d570). History of Geographic Thought. Designed to acquaint students with the aims, methods, and accomplishments of geography as a professional field and a discipline in the past, present, and future. (3W)

675 (d575). Geographic Applications of Remote Sensing I. Provides information needed to understand and apply the techniques of remote sensing to a wide range of resource applications. (3)

676 (d576). Remote Sensing II. Advanced techniques in the analysis of earth feature space using remotely-sensed imagery and data in a digital format. Individual projects will employ and/or develop research models. (3)

680 (d580). Teaching Geography. Designed to assist the classroom teacher in the presentation of geographic information. Techniques, methods, and sources of data will be stressed. (3)

681 (d581). Geography Education Workshop. Designed to provide specialization for geography educators through the workshop format. Selected geographic content, methods, and pedagogy will be presented and translated into materials to be designed for K-12 classrooms. (1-6)

682. Geography and Field Practicum. (1-6)

685 (d585). Cartographic Design. Principles and techniques used in design and construction of maps, charts, and map projections. (3F)

687. Ecology Seminar. The Ecology Center schedules regular seminars throughout the school year with ecological scientists from other institutions participating. Ecology majors are required to attend a minimum of 10 such lectures. Register in Fall but attend through Spring. (1F)

688. Advanced Geographic Methods. Designed to acquaint the student with techniques and resources utilized in geographic research. Projects requiring this methodology will be required relating to problems in Cache Valley. (3)

689. Thesis Design. Identifying thesis topics, design, writing, and presentation. (3F)

691. Independent Research. (1-6)

692. Graduate Seminar. (1-3)

693 (d583). Geographic Information Systems. Fundamentals of geographic information systems, data structures, data input and output, data manipulation, and analysis. (3W)

694 (d594). Geographic Information Analysis. Advanced techniques of spatial analysis on digital data bases using various data formats separately and in combination. (3F)

697. Thesis Research. (1-15)

698 (d598). Special Topics. Designed to present special topics and depth study of topics of present concern. (1-6)

699. Continuing Graduate Advisement. (1-3)

© Repeatable for credit. Check with major department for limitations on number of credits that can be counted for graduation.

*Parenthetical numbers preceded by d indicate a dual listing.

*Taught 1955-96.

Department of Geology

College of Science

Head: Associate Professor Donald W. Fiesinger, igneous petrology
Office in Geology 205, 797-1273

Professors W. David Liddell, paleoecology, invertebrate paleontology; Robert Q. Oaks, Jr., sedimentary petrology; Professor Emeritus Clyde T. Hardy, structural geology; Associate Professors James P. Evans, structural geology, structural petrology; Peter T. Kolesar, carbonate petrology, low-temperature geochemistry; Assistant Professors Susanne U. Janecke, structural geology, tectonics; Darrell S. Kaufman, Quaternary chronostratigraphy; Thomas E. Lachnir; hydrogeology; Adjunct Assistant Professors Sharon L. Otkorston, coral reef ecology, invertebrate biology; John C. Schmidt, fluvial geomorphology

Degrees offered: Master of Science (MS) in Geology and in Geology Ecology

Specializations: Geochemistry, Hydrogeology, Igneous Petrology, Paleocology, Sedimentary Petrology, Structural Geology, Surficial Geology

Admission Requirements

See general admission requirements on pages 25-26. In addition, applicants must have acceptable GRE scores. Minimum scores of 40th percentile on the Verbal section and 40th percentile on the Quantitative section and a combined minimum of 1,000 are required. The advanced GRE in geology is recommended but not required. A member of the Geology faculty must agree to serve as the major professor for the applicant prior to acceptance.

Applications will be considered throughout the year, but program entry in fall quarter is preferred. Students who wish to be considered for assistantships or other financial aid must have complete applications on file no later than February 15 for entry to the program the following fall quarter.

Prerequisites for Matriculation

Completion of a BS or BA in Geology, Biology, Physics, Chemistry, or Engineering is required for matriculated status. Suggested prerequisite courses include: Chem 121, 122, 123, 124, 160, Phys 221, 222, 223; Math 220, 221; and CS 160 or Stat 301. Deficiencies in Geology are determined based on anticipated research specialization
and current USU undergraduate degree requirements for either the general geology track or hydrogeology-engineering geology track, as appropriate.

**Degree Requirements**

The department offers advanced study and research leading to the MS degree in Geology or Geology-Ecology. Most geology research specialties require advanced courses selected from geology offerings. Special emphases are available in paleobiology and hydrogeology-engineering geology.

For the paleobiology emphasis, advanced courses are selected from both biology and geology. Some substitution of undergraduate biology courses is allowed to meet matriculation requirements. For the Hydrogeology-Engineering Geology option, advanced courses are selected from geology, civil and environmental engineering, soil science, and mathematics. The Hydrogeology-Engineering Geology option is offered in collaboration with the Department of Civil and Environmental Engineering and the Utah Water Research Laboratory.

Only the Plan A thesis option is allowed for the MS degree in Geology. The recommended distribution is 30 credits of coursework and 15 credits of thesis to obtain the required 45 credits for the degree. A minimum of five 600-level geology courses (other than Geol 680) is recommended for the degree program. Only two grades of C+ or lower will be accepted as part of the required degree program as listed on the Application for Candidacy for the Master's Degree. A 3.0 GPA must be obtained on required coursework as listed on the Application for Candidacy. Thesis credits will be graded P-F only. Geology graduate students using department or University facilities and/or under geology faculty supervision must register for a minimum of 3 credits every quarter, including summer, up to and including the quarter in which the thesis is cleared by the School of Graduate Studies.

**Research**

There are three broad areas of research emphasis within the department: (1) sedimentary systems and paleoecology, (2) surficial geology and hydrogeology, and (3) structural geology and tectonics.

Research in the broad area of sedimentary systems and paleoecology has been focused on sedimentation and development of coral reefs and associated carbonate environments during Pleistocene and Holocene time, changes in shallow-water carbonate environments through early Paleozoic time, and deposition of detrital sediments in Precambrian and Paleozoic time. Research activities are dominantly field oriented, with studies going on in parts of the western United States, Australia, and the Caribbean.

Surficial geology research, in the area of Quaternary geology and geochronology, is concerned with the reconstruction of Pliocene-Pleistocene paleoenvironmental and paleoclimatological change. In hydrogeology, there is research activity on wellhead protection in confined to semiconfined aquifers, the relationships between stream losses and water table depths, and the identification and geochemical characterization of groundwater recharge to surface streams. Hydrogeology also interfaces with surficial geology studies, activities at the Utah Water Research Lab, the Department of Civil and Environmental Engineering, and the Department of Geography and Earth Resources.

Researchers in structural geology examine the mechanical and chemical evolution of fault zones; the structural and tectonic development of extensional structures in the Great Basin; the development of fold-and-thrust structures in Idaho, Montana, Wyoming, and Utah; and characterization of fluid-flow properties in fractured crystalline rocks. Presently, studies in igneous petrology are concentrated on the volcanic rocks in the northern Great Basin and adjacent Snake River Plain (northern Utah, southern Idaho, and adjacent parts of Nevada). The goal of this research is to assess relationships between tectonic and volcanic history in the transition zone between the Basin-and-Range and the Snake River Plain provinces.

**Financial Assistance**

Departmental financial support for incoming students consists primarily of graduate teaching assistantships, which are awarded on a competitive basis. There is often other financial support available, such as research assistantships, from grants or other external funding. Students desiring financial support should apply directly to the department no later than February 15.

**Geology Courses**

*540. Geochemistry.* Explores the application of chemistry to the solution of varied geologic problems. Three lectures per week. Prerequisites: Geol 305 or permission of instructor; Geol 410 recommended. (3W)

*544. Exploration Geophysics.* Survey of geophysical techniques used in exploration for hydrocarbons, groundwater, and ore deposits. Emphasis on field surveys, interpretation of data, and exploration applications. Three lectures and one lab per week. Prerequisites: Geol 310, 370, and Phys 223; or permission of instructor. (4W)

*548. Groundwater Geology.* Introduction to groundwater hydrology; occurrence, movement, and properties of subsurface water. Four lectures per week. Prerequisite: Geol 111 and Math 221 or permission of instructor; Geol 360 recommended. (4F)

*552. Metallic Mineral Deposits.* Origin and geologic occurrence of metallic mineral deposits. Three lectures and one lab per week. Prerequisites: Geol 370, 410, 416. (4Sp)

*554. Petroleum Exploration.* Origin and geologic occurrences of petroleum; sequence stratigraphy, basin analysis, and the search for petroleum; drilling and production, petroleum economics. Three lectures and one lab per week. Prerequisites: Geol 370, 410; or permission of instructor. (4W)

*564. Photogeology.* Interpretation of geologic features on aerial photographs. One lecture and two labs per week. Prerequisites: Geol 360 and 370. (3W)

*580. Clay Mineralogy.* Techniques of clay mineral analysis; detailed clay mineral structures; physico-chemical constraints on clay formation and diagenesis; use of clays in paleoenvironmental interpretation. Three lectures and one lab per week. Prerequisite: Geol 365 or permission of instructor. (4Sp)

*590. Topics for Teachers.* Special topics in geology for elementary and secondary science teachers to provide an understanding of the geology of Utah and the western United States. Emphasis on field and lab activities, and acquisition of geologic materials for classroom use. Prerequisite: Geol 101, 105, or 111; or permission of instructor. (1-SSu)

*614. Interpretation of Sedimentary Rocks.* Interpretation of source areas, depositional environments, and diagenesis of sedimentary rocks based on thin sections and hand samples. Evaluation of literature. Oral and written reports. Three lectures and two labs per week. Prerequisites: Geol 405 and 410. (5Sp)

*616 (d510). 1 Igneous and Metamorphic Petrography.* Classification and description of igneous and metamorphic rocks utilizing petrographic microscope. One lecture and two labs per week. Prerequisite: Geol 416. (4Sp)
**624. Advanced Structural Geology.** Basic relationships which govern material behavior and their application to rock deformation, deformation mechanisms, and structural petrology of sedimentary, igneous, and metamorphic rocks. Three lectures and one lab per week. Prerequisites: Geol 370 and 416. (4Sp)

**625. Mechanics and Processes in Earth Sciences.** Fundamentals of solid and fluid mechanics with applications to the earth sciences. Applications to rock deformation, fluid flow, glacier movement, and slope stability. Designed for graduate students in earth sciences and engineering. Two lectures and one lab per week. Prerequisites: Geol 370 and Math 221, or permission of instructor. (4F)

**631 (d531). Global Geophysics.** Fundamentals of the physics of the Earth's interior and the theory of plate tectonics; recognition of large-scale crustal deformation and plate interactions; tectonic development of North America. Three lectures and one lab per week. Prerequisite: Geol 370. (4F)

**632 (d532). Tectonics of Orogenic Belts.** Survey of tectonic styles and processes along active plate margins; tectonic evolution of the North American Cordillera. Two lectures and one lab per week. Prerequisites: Geol 310 and 370. (4F)

**636 (d536). Paleocology.** Use of fossils in the interpretation of ancient environments. Techniques for the analysis of paleocommunity structure. Three lectures and one lab per week. Prerequisite: Geol 430 or permission of instructor. (4F)

**640. Topics in Hydrogeology (Topic).** An in-depth analytic review of theoretical and applied aspects of advanced topics in hydrogeology drawn from recent literature. Prerequisite: Geol 549 or 649 or permission of instructor. (4F)

**649 (d549). Hydrogeologic Field Methods.** Methods of collection and analysis of field data for groundwater studies. Three lectures and one lab per week. Prerequisites: (1) Geol 549 or (2) Geol 111 and CEE 543, or permission of instructor. (4F)

**662 (d562). Glacial Geology.** Introduction to glaciology, glacial erosion and deposition, isostatic and eustatic effects, North American glacial stratigraphy, and glacial geologic research techniques. Three lectures and one lab per week. Prerequisite: Geol 350 or permission of instructor. (4W)

**668 (d568). Quaternary Climate Change.** Analysis of the causes and effects of climate change, methods used to reconstruct past climates, and dating techniques. Two two-hour lectures per week. Prerequisite: Geol 360 or permission of instructor. (4W)

680. Seminar. (1-6F,W,Sp) ©

697. Thesis. (1-12F,W,Sp) ©

699. Continuing Graduate Advisement. (1-3F,W,Sp) ©

*Taught 1995-96.
**Taught 1996-97.
© Repeatable for credit. Check with major department for limitations on number of credits that can be counted for graduation.

1Parenthetical numbers preceded by d indicate a dual listing.

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**Department of Health, Physical Education and Recreation**

**College of Education**

**Head:** Professor Robert E. Sorenson, administration, health and wellness, stress management

Office in Health, Physical Education and Recreation 122, 797-1497

**Graduate Program Coordinator:** Professor Richard D. Gordin, Jr., motor learning, sport psychology

**Professor Lanny J. Nalder,** exercise physiology, preventive and post-coronary exercise rehabilitation, ACSM Board certified; **Associate Professors Arthur R. Jones,** commercial recreation; **Deana Lorentzen,** history and philosophy in physical education and sport, sports sociology; **Dennis A. Nelson,** recreation administration; **Bradford N. Strand,** pedagogy; **Rolayne Wilson,** elementary physical education; **Assistant Professors Julianne Abendroth-Smith,** biomechanics; **Hilda Fronske,** pedagogy; **Julie A. Gast,** community health; **Steven R. Hawke,** drug education, aging, weight control

**Degrees offered:** Master of Science (MS) and Master of Education (MED)

**Specializations:** Administration of Physical Education, Cardiac Fitness and Rehabilitation for Executive and Aging Populations, Exercise Science, Health Education, Psycho-Social Aspects of Physical Education and Sport, Recreation Leadership, Sports Medicine

**Admission Requirements**

See general admission requirements, on pages 25-26. In addition, the letters of recommendation must be written by professionals in physical education who know the applicant and his/her work well. Students with fewer than 18 credits of undergraduate physical education must make up any deficiencies and basic competencies that have not been acquired through courses or experience by completing prerequisite undergraduate courses without credit before being granted matriculated status. Other nongraduate credit courses may be required by the admissions committee. Students with weak oral or written English skills will be required to take remedial work or complete undergraduate or Intensive English classes.

**Course Requirements**

**Master of Science**

The MS is available to students who plan to teach, provide community leadership, or do further graduate or research study. There are three options:

1. The MS program in physical education requires a minimum of 45 credits and includes research and writing a thesis.

2. A specialization in cardiac fitness and rehabilitation, with emphasis for executives and aging populations, requires a minimum of 60 credits, including a thesis and a
practicum-related option. A nonthesis option is also available.

3. The MS program emphasizing parks and recreation leadership leads to executive level/supervisory positions. This program requires 47 credits of coursework, which includes a thesis.

Core Courses. MS candidates must take HE P 640; PE P 630, 640, 681, 683, 697; and Educ 667. Cardiac Fitness and Rehabilitation students must take HE P 640, 645; PE P 602, 630, 640, 645, 654, 681, 683, 685, 697; and Educ 667.

Master of Education

The MEd is designed for students desiring to improve teaching competencies. Requirements are for 54 credits, including (1) a 12-credit core of courses to prepare individuals to become more knowledgeable, skilled, and responsive in areas of social and philosophical foundations in education; teaching and learning theory and practice; human conditions, individual cultural integrity, and cultural pluralism in society as they relate to teaching; and research and ability to locate, understand, and evaluate research findings, and to adapt research findings to teaching, curriculum, and improvements of instruction; (2) the departmental core of 21 credits designed to provide advanced study in physical education; (3) 12 to 18 credits of supporting coursework; (4) a demonstrated creativity project of 3 credits; (5) student electives; (6) completion of a creative project.

Core Courses. Required courses include SecEd 615, Educ 666, PE P 605, 607, 630, 640, 642, 643, 683, and HE P 640. Students should select one course from the following college core: Hist 541, Educ 669, and SecEd 671.

Research

Research areas include exercise science, cardiac rehabilitation fitness, sport psychology, sport in society, biomechanics, pedagogy, community recreation program planning, and therapeutic recreation; and cooperative research with Educators Mutual Insurance Association (the ongoing Wellness Center), the Western Regional Surgery Center, and the Logan Community Recreation Program.

Financial Assistance

Ten teaching assistantships, two building supervision assistantships, and three second-year hospital assistantships are available through the department and are awarded on a competitive basis. These assistantships are $5,000 each for nine months.

Second-year graduate students participating in the practicum of the Cardiac Fitness and Rehabilitation program are eligible to apply for an additional $2,000 fellowship in association with this program.

Application for the assistantships must be made by March 15 to the department head. A formal application for admission must be submitted to the School of Graduate Studies at the same time as the application for an assistantship. A recipient of a graduate appointment is usually eligible for a waiver of the out-of-state portion of his/her tuition.

Physical Education Courses

555. Practicum in Evaluating School System Programs. An in-service seminar for experienced teachers. Emphasizes a look at strengths and weaknesses of existing programs, proposed programs, and ways to assess specific school or district programs. (1.6)  

556. Practicum in Improving School System Programs. An in-service seminar for experienced teachers which emphasizes improvement of instruction. (1.6)  

590. Independent Study. (1-3)  

591. Independent Research. (1-3)  

600 (d500). Administration of Athletics. Prepares students to organize and administer interscholastic and intercollegiate sports at the public school or university level. Consideration is given to both the challenges and standards associated with such programs. (3Sp)

601 (d501). Leadership in Health, Physical Education and Recreation. A group approach to improvement in leadership and supervisory skills. Familiarization with administrative skills and duties through discussion and lab approach. (3Sp)

602. Seminar in Risk Reduction. Guest "experts" in various scientific descriptives present and lead discussions on specific risk factors and their reduction in healthful living. (1W)

605 (d505). Psychological Aspects of Sports Performance. Psychological theory and principles applied to sports. Includes motivational techniques, psychological evaluation, stress and anxiety in sports, personality and sports performance. (3Sp, Alt Su)

607 (d507). Sport in Society. Introduces students to complex role and social significance of sport in contemporary society; students become familiar with aims, scope, and potential contributions of sport in society. (3F)

625. Graduate Cooperative Work Experience. Professional level of educational work experience in a cooperative education position for graduate students. (1-1SF,W,Sp,Su)®

630. Advanced Biomechanics. Biomechanical and anatomical analysis of sports and motor performance. (3F, Alt Su)

640. Advanced Exercise Physiology and Laboratory Practicum. Specifically designed to familiarize students with the advanced exposure to the effects of exercise upon the body systems. Involves a laboratory experience. (5F, Alt Su)

642. Curriculum in Physical Education. Curriculum development studied in terms of student needs in relation to present-day society. Includes current practices and trends in the area of curriculum. (3W, Alt Su)

643 (d543). History and Philosophy of Physical Education and Sport. History of physical education; philosophical influences which have contributed to contemporary physical education; methods of educational instruction using the primary philosophical positions. (3W)

645. Electrocardiography and Exercise Testing Protocols. Designed to acquaint students with basic resting and exercise electrocardiography. Exercise protocol selection techniques will be included in the course. (5W)

650. Interdisciplinary Workshop. (1-3Su)®

654. Exercise Prescription Writing. Transformation of exercise test results into a workable exercise prescription. Data interpretation and evaluation of test results are a part of this course. (3Sp)

655. Practicum in the Evaluation of Instruction. A field-based research study contributing toward graduate degrees and supervisory certification related to the assessment of an ongoing or newly proposed program of instruction. (1-6)®

656. Practicum in the Improvement of Instruction. A field-based program focused upon characteristics of effective teaching methodologies, teaching performance, curriculum decision-making, value guidelines, and the characteristics of the learner. (1-6)®

657. Practicum in Cardiac Rehabilitation and Adult Fitness. Experiences designed for the practical implementation of coursework. Involves random population rehabilitation as well as executive and industry, senior citizen centers, and rest homes. (1-10F,W,Sp,Su)

660. Analysis of Teaching Physical Education. Designed to provide graduate students with practical experiences in the analysis of physical education classes. (1-5F,W,Sp,Su)®
education via micro teaching and observation of physical education classes. (3Sp)

681. Research Seminar. This course covers the basic to advanced concepts contained in the research design and statistical design areas of research. (3F, Su)

683. Motor Learning. Comprehensive review and analysis of research in the area of motor skills which bears upon the teaching of physical education activities. (3W, Alt Su)

685. Principles and Techniques of Conditioning and Rehabilitation. Designed to provide the student with knowledge and experiences for effective implementation of the exercise prescription. (3Sp)

690. Independent Study. (1-3) ®

691. Independent Research. (1-3) ®

696. Master's Project. Designed to allow students the opportunity to develop a creative and applicable educational project. (3F, W, Sp, Su)

697. Thesis. (1-9) ®

699. Continuing Graduate Advisement. (1-12) ®


790. Independent Study. Variable topics course involving independent study for doctoral students. (1-3F, W, Sp, Su) ®

791. Independent Research. Variable topics course involving independent research for doctoral students. (1-3F, W, Sp, Su) ®

Parks and Recreation Courses

500. Aquatic Recreation Resource Management. Study of the principles, practices, and guidelines for management of effective public and private aquatic resources. Focus on planning, development, and facility design. (3Sp)

551. Philosophy of Recreation. Insight into the problems and issues Americans face as the result of increased leisure. Exploration of possible solutions to these problems through the medium of recreation. Prerequisite: PR P 410 or adviser's approval. (3W)

555. Recreation Park and Facility Management. Study of recreation park and facility management, including an examination of supply, demand, population, maintenance, and safety analysis in developing appropriate areas and facilities for parks. Prerequisite: PR P 100. (3Sp)

590. Independent Study. (1-3) ®

591. Independent Research. (1-3F, W, Sp, Su) ®

600 (d450). Recreation for Diverse Populations. Examination of leadership and programming techniques and strategies used to meet the recreational needs of individuals in all populations, including those with disabling conditions. (3F)

601 (d501). Leadership in Health, Physical Education and Recreation. A group approach to improvement and innovation in leadership and supervisory skills. Familiarization with administrative skills and duties through discussion and lab approach. (3W)

605 (d505). Therapeutic Recreation. An analysis of various special population groups served by recreation; the clinical application of recreation programs and activities; special institution's procedures, terminology, and operation. Prerequisite: PR P 600/450. (3F)

625. Graduate Cooperative Work Experience. A professional level of educational work experience in a cooperative education position for graduate students. (1-15F, W, Sp, Su) ®

650 (d525). Advanced Therapeutic Recreation. Highlights the advanced protocol procedures of disability identification, program development, treatment planning, progress note writing, and protocol evaluation. Prerequisite: PR P 605/505. (3Sp)

652 (d552). Recreation Administration. Problems of organization and administration of parks and recreation departments, including personnel management considerations. (3W)

680 (d480). Seminar in Recreation. Student presentation of thesis and project studies. Informal discussions, critical analysis of problems, informal lectures by invited speakers and class members. (3F)

690. Independent Study. (1-3) ®

691. Independent Research. (1-3) ®

697. Thesis. (1-9) ®

699. Continuing Graduate Advisement. (1-12) ®

Health Education Courses

555. Practicum in Evaluating School System Programs. An in-service seminar for experienced teachers. Emphasizes a look at strengths and weaknesses of existing programs, proposed programs, and ways to assess specific school or district programs. (1-6) ®

556. Practicum in Improving School System Programs. An in-service seminar for experienced teachers which emphasizes improvement of instruction. (1-6) ®

590. Independent Study. (1-3) ®

591. Independent Research. (1-3) ®

610 (d510). Current Trends in Health Education. Focuses on trends and issues in health, analyzes directions in which health education can go to confront the issues and formulate solutions. (3Sp)

625. Graduate Cooperative Work Experience. A professional level of education work experience in a cooperative education position for graduate students. Credit arranged. (1-15F, W, Sp, Su)

640. Stress Management. Deals with concepts and principles which help individuals to maximize positive stress outcomes and minimize negative stress effects in obtaining and maintaining a normal, healthy homeostatic condition. (3W)

645 (d545). Health Aspects of Aging. Major physical health aspects of aging and the aged including life expectancies, diseases, diet and exercise, medical care, death, loneliness, and communication with the aged. (3W)

655. Practicum in the Evaluation of Instruction. A field-based research study contributing toward graduate degrees and supervisory certification related to the assessment of an ongoing or newly proposed program of instruction. (1-6) ®

656. Practicum in the Improvement of Instruction. A field-based program focused upon characteristics of effective teaching methodologies, teaching performance, curriculum decision making, value guidelines, and the characteristics of the learner. (1-6) ®

682. Seminar in Health Education. (1-5) ®

690. Independent Study. (1-3) ®

691. Independent Research. (1-3) ®

697. Thesis. (1-9) ®

699. Continuing Graduate Advisement. (1-12) ®

© Repeatable for credit. Check with major department for limitations on number of credits that can be counted for graduation. ¹Parenthetical numbers preceded by d indicate a dual listing.
Department of

History

College of Humanities, Arts and Social Sciences

Head: Professor Norman L. Jones, medieval, renaissance, reformation Europe
Office in Main 323, 797-1290

Director of Graduate Studies: Professor Carol A. O'Connor, American urban, twentieth century

Professors Jay Anderson, folklore, material culture, and folk art; Anne M. Butler, American West, women; Stanford Cazer, American intellectual; C. Robert Cole, England, modern Europe; R. Edward Glatfelter, Russia, East Asia; William F. Lye, Africa, British Empire; Clyde A. Milner II, nineteenth century, American Indian; F. Ross Peterson, contemporary America, Afro-American; Barre Toelken, folklore, mythology, native American literature, ethnic studies; Professors Emeriti S. George Ellsworth, Utah, Greece, Rome; Charles S. Peterson, American West; Associate Professors Mark L. Damen, classics; David R. Lewis, American Indian, Utah, American West; Daniel J. McNemey, nineteenth century, American intellectual; Michael L. Nicholls, early America; Leonard N. Rosenband, European social history; Steven Siporin, folklore, applied folklore, American studies; Frances B. Titchener, classics; Adjunct Associate Professor A. J. Simmonds, Utah; Adjunct Assistant Professors C. Blythe Ahlstrom, progressivism and reform; Bradford R. Cole, American West; Denise O. Conover, twentieth century; Robert E. Parson, American West; Adjunct Instructor Carol McNamara, ancient Western civilization

Degrees offered: Master of Science (MS), Master of Arts (MA); participates in Master of Social Sciences (MSS)

Specializations: Standard Program, American Studies

Course Requirements

MA and MS in History. Plan A is recommended for all students who intend to continue graduate work beyond the master's degree, whether in academic or applied programs. Students under this plan are urged to meet the language requirements necessary for the MA. A two-year college level of competency in a foreign language is required and may have been earned at the undergraduate level. An acceptable thesis must be submitted for which a maximum of 9 credits will be given. The student is required to defend his or her thesis and historical knowledge in an oral examination before the committee. Twelve credits or more must be earned in colloquia and seminars, including Hist 600.

Plan B is recommended for all students pursuing a career of teaching history in the secondary schools or who wish to develop an applied history component. Under this plan, a Plan B paper and 12 credits in graduate seminars and colloquia (600 series) are required, including Hist 600. Plan B students can apply no more than three hours of thesis credit to the 45 credit hours required for the degree. Plan B students must successfully complete a written examination in two areas of emphasis. The general fields from which the students may select their two areas of emphasis are (1) American history, (2) non-American history, and (3) applied history.

The requirement for the master's degree under Plan A or Plan B is 45 credits. In addition to the graduate-level courses listed below, students are encouraged to complete their programs in related subject area courses from the undergraduate offerings. As graduate students enrolled in undergraduate courses, students will be required to complete additional, graduate-level assignments. For students without strong backgrounds in history, the department may determine that additional undergraduate work is required. For further information, contact the director of graduate studies.

MA and MS in American Studies. The department cooperates with the Department of English in administering the graduate program leading to the master's degree in American Studies. See the English Department description for a statement on that program.

Master of Social Sciences. This degree enables interdisciplinary training in three related disciplines designed for secondary school teachers. This program requires a minimum of 61 credits, including 24 credits in a major discipline; either: (1) a minimum of 12 credits in each of two minors or (2) a minimum of 12 credits in a minor and a minimum of 12 credits in a cluster, and 3 credits for a Plan B Paper. An overall GPA of 3.0 is required. Individual options and plans of study can be arranged in consultation with the student's supervisory committee. Acceptable minor disciplines for teaching certificate candidates must be those that are certifiable in the State of Utah. For further information, see pages 41-42 and/or contact the director of graduate studies.

Financial Assistance

Departmental and/or University support is available to graduate students. Six teaching assistantships and two editorial fellowships are awarded by the department. All awards are on a competitive basis. Students requesting financial support should apply to the department by February 1.

History Courses

513. Economic History of Russia. Development of the Russian economy from earliest times to 1980, emphasizing the interaction between economic forces and policies of the state. (3)
<table>
<thead>
<tr>
<th>Course Number</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>541</td>
<td>Cultural History of the United States. A social and intellectual history of the United States with emphasis on the development of major thought patterns in relation to their social-economic context. (5)</td>
</tr>
<tr>
<td>543</td>
<td>The American Frontier. Upper division interdisciplinary seminar designed to synthesize, amplify, and enrich the content of a block of general education courses taken concurrently as prerequisite to the seminar. (3)</td>
</tr>
<tr>
<td>545</td>
<td>Constitutional History of the United States. Survey of the evolution of our constitution's history; special emphasis on Supreme Court decisions and philosophies; concludes with analysis of constitution's role in contemporary society. (4)</td>
</tr>
<tr>
<td>585</td>
<td>Special Topics in British History. (3)</td>
</tr>
<tr>
<td>600 (f586)</td>
<td>Historical Method and Research. Research in primary source materials to illustrate historical method. Required for History master's students. Should be taken at the beginning of student's master's program. Recommended to students in other fields making use of the historical method in their research. (3F)</td>
</tr>
<tr>
<td>601 (f588)</td>
<td>Local History Methods. Research seminar stressing the literature, sources, and methodology of local studies. (3W)</td>
</tr>
<tr>
<td>602</td>
<td>Historical Criticism: Practicum. Students prepare critiques of the student-prepared projects entered in the Utah History Fair state-wide competition. Students will operate a one-day workshop for the History Fair finalists. (3)</td>
</tr>
<tr>
<td>603</td>
<td>Historiography. The history of historical writing. (3)</td>
</tr>
<tr>
<td>604</td>
<td>The Social and Economic History of Modern Europe. An advanced investigation of major issues in the social and economic history of modern Europe. (3Sp)</td>
</tr>
<tr>
<td>605</td>
<td>Philosophy of History. Interpretations, causation, and interrelations in history. (3)</td>
</tr>
<tr>
<td>610</td>
<td>Colloquium in Special Studies. Intensive readings and discussions in special themes or areas. (3)</td>
</tr>
<tr>
<td>612</td>
<td>Archives Management. Study of the management of archival collections. Emphasis on the processing and conservation of manuscript and photographic materials. Case studies in identification, processing, and preservation. (3)</td>
</tr>
<tr>
<td>613</td>
<td>Historical Editing. Training in the editing of historical documents. (3)</td>
</tr>
<tr>
<td>614</td>
<td>Historical Preservation. Techniques of surveying and recording potential historical sites and districts for inclusion on state and national register and for purposes of historical preservation. (3)</td>
</tr>
<tr>
<td>620</td>
<td>Colloquium in European History. Intensive readings and group discussions of literature on selected themes in European history. (3)</td>
</tr>
<tr>
<td>621</td>
<td>European History. Investigations of specific periods, countries, and themes in European History. (1-5)</td>
</tr>
<tr>
<td>622</td>
<td>Folk Narrative. Principal genres of folk narrative (Marchen, tales, legends, folk histories, ballad, etc.) and the theoretical issues associated with their study. (3F, W, Sp, Su)</td>
</tr>
<tr>
<td>624 (d524)</td>
<td>Regional Folklife. Regional folklore of a specific region, identified each quarter taught. (3)</td>
</tr>
<tr>
<td>630</td>
<td>Colloquium in American History. Intensive readings and group discussions of literature on selected themes in American history. (3)</td>
</tr>
<tr>
<td>631</td>
<td>American History. Investigations of specific periods and themes in American history. (1-5)</td>
</tr>
<tr>
<td>635</td>
<td>Colloquium in Western American History. Intensive readings and group discussions of literature on selected themes in American frontier history. (3)</td>
</tr>
<tr>
<td>637</td>
<td>Teaching Utah History. Seminar in the sources and literature of Utah history; exercises in the preparation and presentation of materials. (3)</td>
</tr>
<tr>
<td>644 (d596)</td>
<td>American West: Its Literature and History. (2-3)</td>
</tr>
<tr>
<td>646 (d546)</td>
<td>Folk Groups and Folklife Genres. Survey of folk groups and folklife genres. Taught during Fife Folklife Conference only. (See English 646). (3Su)</td>
</tr>
<tr>
<td>650</td>
<td>Colloquium in African History. Intensive readings and group discussions of literature on selected themes in African history. (3)</td>
</tr>
<tr>
<td>651</td>
<td>African History. Investigations of specific periods, countries, and themes in African History. (1-5)</td>
</tr>
<tr>
<td>657</td>
<td>American Studies Internship in Mountain West Culture. Internships will be available at local or regional sites where interns will gain practical experience in museology, management, or historical farm development and operation. (2-13)</td>
</tr>
<tr>
<td>660</td>
<td>Colloquium in East Asian History. Intensive readings and group discussions of literature on selected themes in East Asian history. (3)</td>
</tr>
<tr>
<td>661</td>
<td>Asian History. Investigations of specific periods, countries, and themes in Asian History. (1.5)</td>
</tr>
<tr>
<td>669</td>
<td>Themes in Folklife. Leading themes in folklife study as applied to the interpretation of cultural, social, and historical phenomena. Folklife as related to one of the following: gender, family, ethnicity, religion, history, politics, etc. Graduate standing required. (SF, W, Sp, Su)</td>
</tr>
<tr>
<td>670</td>
<td>Colloquium in Latin American History. Intensive readings and group discussions of literature on selected themes in Latin American history. (3)</td>
</tr>
<tr>
<td>671</td>
<td>Latin American History. Investigations of specific periods, countries, and themes in Latin American History. (1.5)</td>
</tr>
<tr>
<td>672 (d372)</td>
<td>Folklife Colloquium. Issues, problems, and methodologies in folklife study. (3)</td>
</tr>
<tr>
<td>673</td>
<td>Studies in Folklife. Study and interpretation of material culture (folk art, vernacular architecture, vernacular tools, etc.) and customary expressions of everyday life (customs, festivals, foodways, etc.). Theoretical analysis of these genres; museum and living-museum exhibits and interpretations. (3F, W, Sp, Su)</td>
</tr>
<tr>
<td>674</td>
<td>Outdoor Museum Planning and Administration. Introduction to planning and evaluation of folklife museums. Topics covered include mission statement, objectives, collecting and conservation policy, educational and interpretive programs, and physical development. (3)</td>
</tr>
<tr>
<td>675</td>
<td>Outdoor Museum Research and Conservation. Seminar on particular research and curatorial needs of folklife museums. Emphasis on documentation of material culture, selection of interpretive themes, and development of materials for interpretive programs. (3)</td>
</tr>
<tr>
<td>676</td>
<td>Outdoor Museum Interpretation and Educational Programming. Seminar on interpretive programs at folklife museums. Focus on living history, the use of historical simulation to re-create the everyday lives of ordinary people. (3)</td>
</tr>
<tr>
<td>677</td>
<td>History Museum Internship. Directed internship at a regional indoor or outdoor history museum or participation in a historical research or interpretive project at a cultural institution, for example, a state park, national forest, historic site, or folklife festival. (0-12)</td>
</tr>
<tr>
<td>678</td>
<td>Scholarly Editing Internship. Training in the requirements of editorial work in scholarly journals and books. Emphasis is placed on editing technique and the mechanics of editorial work. (2-5)</td>
</tr>
<tr>
<td>679 (d579)</td>
<td>Folklife Fieldwork. Introduces advanced student to problems and techniques of fieldwork, including making sound recordings of orally-transmitted expressions, photographs of material traditions, and descriptions of problematic genres. Technical training, ethics, field exercises, analysis, plus perspectives on archiving and publication of results. (3)</td>
</tr>
<tr>
<td>689</td>
<td>Research Seminar. Research in primary sources for graduate and senior students. (3)</td>
</tr>
<tr>
<td>691</td>
<td>Readings and Conferences in Special Areas. (1-3)</td>
</tr>
<tr>
<td>697</td>
<td>Thesis Research. (1-9)</td>
</tr>
<tr>
<td>699</td>
<td>Continuing Graduate Advisement. (1-3)</td>
</tr>
</tbody>
</table>

* Repeatable for credit. Check with major department for limitations on number of credits that can be counted for graduation.

1 Parenthetical numbers preceded by (?) indicate a dual listing; parenthetical numbers preceded by an * are the former course numbers.
Department of

Human Environments:
Apparel Merchandising, Interior Design,
Consumer Sciences, and Home Economics Education

College of Family Life

Head: Professor Joan R. McFadden, housing, household technology, education
Office in Family Life 303, 797-1558

Professors Leona K. Hawks, housing, home furnishings, household equipment, extension; Jean M. Loun, consumer and family economics; Janet E. Preston, home economics education; Associate Professors Jane L. McCullough, family resource management; Marilyn B. Noyes, family resource management, extension; Tom C. Peterson, interior design; Elizabeth Rogers, interior design; JoAnn Wilson, interior design; Assistant Professors Luella F. Anderson, social and historic aspects of apparel; Jeanette J. Arbuthnot, merchandising; Ann C. Deegan, textiles; Elizabeth E. Gorham, family resource management, extension; Instructor Louise P. Young, apparel merchandising, extension

Degree offered: Master of Science (MS)

Specializations: Clothing and Merchandising, Consumer Sciences, Home Economics Education

Admission Requirements

See general admission requirements (pages 25-26). With permission, students may use the Miller Analogies Test (MAT) in lieu of the GRE. In addition, a student without an undergraduate degree in the area to which he or she is applying may be required to complete selected undergraduate courses prior to admission as a fully matriculated graduate student.

Specializations

The MS program offers three specializations. A student may choose clothing and merchandising, consumer sciences, or home economics education. Plan A (thesis) is available in all specializations. Plan B is clearly defined in home economics education, and clothing and merchandising. A distance learning option is available in home economics education. Plan C is encouraged for this option. Plan A, Plan B, and Plan C options are described on pages 30-31 of this catalog.

Clothing and Merchandising. The clothing and merchandising emphasis offers two options: (1) apparel merchandising, and (2) socio/psychological-historical. Both options can prepare students for teaching, extension, or doctoral programs. Apparel merchandising students may also wish to focus on a business career. Socio/psychological-historical students may also be interested in careers in the museum field. Departmental courses are offered in fashion theory, behavioral aspects of dress, international apparel and textile trade, research trends, and clothing and merchandising problems, including archaeological/historical textile analysis. Electives allow concentrations in such areas as business, anthropology, sociology, design, and history.

Consumer Sciences. An MS with an emphasis in consumer sciences has, at its foundation, theory in management and decision-making processes as related to allocation of household resources. Students may focus on family economic issues, consumer problems, or family resource management. The degree could lead to positions in college teaching, social services, consumer affairs, business, family financial counseling, or cooperative extension service.

Home Economics Education. The course of study is designed for home economics educators. Options for concentration are curriculum/program development or extension. Each option includes coursework in education, home economics, and the area of individual student interest.

The requirements of the options of curriculum/program development and extension may be filled by a 45-credit program with thesis, a 45-credit Plan B option, or a 51-credit plan that includes a practicum and a report. The student must have a bachelor's degree in home economics education and should have had two years teaching experience or the equivalent experience in a home economics related occupation.

Core Courses

Courses common to all emphases include H Env 671 and 675.

Research

Faculty in the department have active, ongoing research projects. Graduate students have the opportunity to participate in many of these projects.

Financial Assistance and Assistantships

Teaching and research assistantships are available from the department and from faculty with funded research projects. The nature of each assignment varies depending on student qualifications and departmental or faculty needs. Applications for assistantships and several scholarships are available through the department. Application deadline for full quarter is April 1, but applications are accepted throughout the year. Scholarship applications are due March 1.
Human Environments Courses

550. Workshop (Topic). (1-3)  

561. Introduction to Software Usage. Basic operating system usage, word and graphic processing for VAX, IBM compatibles, and Macintosh systems. (1F,Sp)  

*602. Fashion Theory. Investigation of theories that contribute to the current understanding of fashion. (3W)  

*604. Research Trends and Presentation Techniques in Human Environments. Analysis of current research trends in Human Environments. Emphasis on professional skill development in areas of oral, video, and poster session presentation of research findings. (3F)  

606 (d406), 2 Behavioral-Science Concepts in Dress. Application of concepts from cultural anthropology, economics, psychology, and sociology to the study of clothing, personal appearance, and consumer behavior. Recommended: one sociology or psychology course. (3F)  

**612. Administration and Supervision in Home Economics. Application of research and theory of administration and supervision to define and clarify the role of leadership to home economics. (3Sp)  

615. Home Economics Classroom Management and Discipline. A multiple strategy approach for increasing teachers' effectiveness and satisfaction in home economics classroom management and discipline. (3Sp)  

617. Curriculum Development. Current trends in curriculum development and special programs related to specific educational programs. (3Sp)  

*618. Curriculum Testing and Evaluation. Field testing of curriculum for use in homemaking and consumer education at the secondary school level. (3Sp)  

*620. International Apparel and Textile Trade. Trade theory: the globalization system, exploration of significant factors contributing to the exchange of apparel, and textile goods in the world market. (3Sp)  

*622. Teaching Techniques for Human Sexuality. Exploring techniques applicable for teaching human sexuality in vocational programs. Utilization of VCR for evaluation and analysis. (3)  

625. Graduate Internship. For graduate students who wish to acquire or upgrade their experience in an occupational field related to their area of study. One credit per 40 hours of experience. (1-12F,W,Sp,Su)  

**629. Family Economic Status. Identifies demographic characteristics and changes of American household income adequacy including: macroeconomic factors, wages, occupation, and marital status. Analyzes U.S. welfare policy. (3F)  

**630. Consumer Problems. Identifies consumer problems and economically efficient solutions. Topics include: consumer information policy; social responsibility of business and corporate consumer affairs programs; benefit-cost analysis of government consumer policy. (3Sp)  

634. Advanced History of Textiles and Apparel I. Critique of movies, classical plays, and on-campus theatre productions to determine if costumes portray the time period accurately. Development of visuals illustrating the effects of technology, economic conditions, and political issues on fashion trends. (4W)  

*635. Family and Economic Change. Impact of economic change on family resources and family division of labor in developing countries. (3)  

638. Advanced History of Textiles and Apparel II. Reading and presentation of selected articles from research literature on the history of textiles and clothing. Hands-on experience with inventory, storage, and conservation of textiles and clothing items from the nineteenth and twentieth centuries. (4Sp)  

640. Current Perspectives in Home Economics Education. Survey of current issues in home economics education. (3-F)  

645. Adult Education in Home Economics. Explores current program formats and instructional materials developed for adult education. Emphasis is on program and course development and teaching strategies suitable to adults. (3W)  

649. History and Philosophy of Home Management. (3F)  

652. Consumer Studies Resources. A survey of current issues, literature, and teaching materials in the area. (3W)  

*655. Consumer Credit. Overview of selected consumer credit topics, recent developments, and legislation; analysis of research and assessment of public policy implications. (3Sp)  

656. Family Financial Problems. Review of research on family financial problems including bankruptcy, unemployment, and analysis of public policies. (3F)  

662. Using and Interpreting SPSS to Analyze Social Research Data. Use of SPSS for descriptive statistics, contingency table, ANOVA models, and multiple regression. Syntax, procedure options, and interpretation of output. Prerequisite: Statistics course. See instructor before enrolling. (3F,Sp)  

*665. Current Developments in Housing. Comprehensive and critical review of literature and research related to modern developments and issues in family housing, to include functional and aesthetic qualities of housing. (3Sp)  

666. Clothing and Merchandising Problems. Investigative approach to selected themes related to current or historical problems in clothing and/or merchandising. (3Sp)  

667 (d487). Apparel Marketing Strategies. Application of effective apparel merchandising practices for small and large retail businesses. Prerequisites: H Env 386, 390, BA 350, or consent of instructor. (3F)  

669 (d489). Current Issues in Apparel Merchandising. Current problems in clothing and textiles. Focus is on topics of interest in Apparel Marketing. Prerequisite: senior standing. (3Sp)  

670. Home Economics Colloquium. Survey of current research and problems. (1-3)  

671. Seminar. Opportunity for investigation and reporting on current issues related to human environments. (1-3)  

674. Advanced Textile Problems. Evaluation of the physical, economic, and aesthetic properties of textile products to determine suitability for a desired end use. Two one-hour lectures and one two-hour lab per week. Prerequisite: H Env 386. (3W)  

675. Current Issues in Research. Survey of current issues in home economics related research. (3)  

680. Research Methods in Human Environments. Techniques and tactics in designing and analyzing social science human behavior research; emphasis on design, instrumentation. Prospectus required. (3)  

690. Independent Study. (1-5F,W,Sp,Su)  


999. Continuing Graduate Advisement. (1-3F,W,Sp,Su)  

700. Leadership in Vocational Education. Supervision and leadership theory with practical application to roles of vocational educators as leaders, supervisors, administrators in educational programs, cooperative extension, and similar settings. (3)  

733. Supervision Practicum. Directed activities in curriculum development and supervision in the public schools. (3-12)  

781. Research Seminar. Seminar in vocational home economics education providing opportunities for investigation and reporting of individual problems. (1-6)  

797. Dissertation Research. (1-18)  

*Taught 1995-96.  
**Taught 1996-97.  
1 Repeatable for credit. Check with major department for limitations on number of credits that can be counted for graduation.  
1 Taught on demand.  
2 Parenthetical numbers preceded by d indicate a dual listing.
Department of

Industrial Technology and Education

College of Engineering

Head: Professor Maurice G. Thomas, industrial technology
Office in Industrial Science 112F, 797-1795

Professor Jay C. Hicken, technology education; Associate Professors Kurt Becker, technology education; Ward P. Belliston, electronics; Reed M. Nielsen, Jr., welding; Edward M. Reese, technology education; Gary A. Stewardson, technology education; David P. Widauf, composite materials; Assistant Professors Barbara A. Snoden, aviation; Charles E. Tinney, electronics

Degree offered: Master of Science (MS) in Industrial Technology

Specializations: Industrial Technology, Technology Education, Trade and Industrial Education

Admission Requirements

See general admission requirements, pages 25-26. Students applying for admission to the MS program must complete the GRE with a minimum quantitative and verbal score of 1,000 and a 40th percentile minimum score on the verbal and quantitative tests or must complete the MAT with a minimum score of 43. Admission committees also consider experience, undergraduate record, and formal recommendations.

Financial Assistance

The department offers a limited number of graduate research and teaching assistantships. Students requesting financial support should apply to the department by March 15.

Industrial Technology and Education Courses

504. Manufacturing Enterprise. Focuses on management technology used to establish a manufacturing firm, engineer a product and production system, finance the operation, and market the product. Prerequisite: ITE 103. (3P)

521. Class and Facility Organization and Management. The process, purpose, and results of a well-planned facility and instructional program with emphasis on safety and efficiency. (3Sp)

522. Analysis and Course Development. Principles and practice in analyzing occupations for instructional purposes. Selection and arrangement of instructional materials for industrial education coursework. Prerequisite: admission to teacher education, SecEd 301, and ITE 303. (3F)

523. Technical Training for Innovative Programs. Preparing prospective and incumbent teachers to implement and conduct contemporary programs. Skill development and the philosophy needed to innovate are included. (1-6F,W,Sp,Su)®

524. Principles of Technology. An introduction to the applied technology principles that form the basis for today's society. (2-5Sp,Su)

550. Technology and Society. A study of the dynamic interaction between technology and society and responsibility of humans in directing changes of our future. (Sp)


574. Principles of Material Science. Fundamentals of materials science such as bonding, structure, defects, and properties of metals, ceramics, and plastics are discussed. Testing of materials also studied. Prerequisites: ITE 285, Math 216. (3F)

575. Welding Metallurgy. Metallurgy principles are applied to welding and testing of steels, stainless steel, and alloys of aluminum, titanium, nickel, and copper. Prerequisite: ITE 574. (3W)

576. Weldability of Metals. Applications of weldability and testing of base and filler metals. Prerequisite: ITE 575. (3Sp)

580. Seminar. Prerequisite: senior status. (1-3F,W,Sp,Su)®

590. Workshop in Industrial Technology and Education. Special workshops for education or industry. May be repeated, provided content varies. (1-6F,W,Sp,Su)®

591. Special Problems in Industrial Education. (1-6)

Core Courses

The core courses for the education option (MS) are ITE 609, 610, 645, 651, 661, 675. The core courses for the industrial technology option (MS) are ITE 675, 697, and Stat 502.

Specializations

The MS program offers three specializations. Students may choose industrial technology, technology education, or trade and industrial education. Plan A and Plan B are allowed in each emphasis. Plan A and Plan B options are described on pages 30-31 of this catalog.

Technology Education. The technology education/applied technology education specialization is designed for industrial educators who want to strengthen their background in current educational theory and practice. Students are required to complete a professional core of courses relating to technology education or applied technology education and to select additional courses from a list of related courses. Plan A requires a minimum of 45 credits, which includes a thesis. Plan B is a nonthesis option that requires 53 credits, including the development of a creative project.

Industrial Technology. The industrial technology specialization is for individuals seeking careers in industry who wish to strengthen their background in industrial materials, processes, and manufacturing management. Enough flexibility is allowed in the program requirements for students to meet their individual goals. Plan A is strongly encouraged for this emphasis, but Plan B is allowed for unique projects.
592. Related Technical Training in IE. (1-18)

609. Curriculum for Technology Education. A study of contemporary curriculum and the adaption, adoption, and development process. (3)

610. Issues and Trends in Technology Education. A study of present and future foundational professional developments in technology education. Students will investigate and identify contemporary trends and issues affecting and facing technology education. (3Su)®

620 (d420). Composite Manufacturing Processes. Composite manufacturing processes, composite materials survey, tooling design and fabrication, autoclave processes, vacuum bag techniques, filament winding processes, equipment requirements, materials cutting and storage, composite materials testing. Prerequisite: Chem 111. (4W)

625. Internship. Advanced specialized instruction through supervised assignment in teaching, supervising, or administering curriculum in the public schools or state office. (1-12F,W,Sp,Su)

630 (d430). Corrosion and Corrosion Control. Analysis of the mechanisms of corrosion of ferrous metals, nonferrous metals, and nonmetallic materials and the control of corrosion. Prerequisite: ITE 285. (3Sp)

640. Cooperative Industrial Programs. Essential information for conducting reimbursed work-experience industrial classes in secondary and post-high schools. (3Su)

645. Organization of Industrial Education Programs. Local, state, and federal laws, regulations, and policies affecting industrial and technical education programs; organization of programs at secondary, post-high school, and vocational and technical college level. (3)

651. Administration and Supervision of Technology Education. Administration, supervision, and management required for successful operation of programs. (3)

658 (d458). Industrial Robots. Principles, operation, and application of robots to material handling, assembly, and joining processes. Includes hardware and software applications for industrial technology. Prerequisites: ITE 392 and Math 210. (3)

661. Strategies of Instruction. An advanced method and technique of instruction for technology education. Includes problems and processes of adult, special, and equity education as well as methods for general technology education. (3Su)

663. Welding in Extreme Environments. Basic concepts of welding in extreme environments such as underwater, microgravity and vacuum, cryogenic, and high temperatures are studied and practiced in the laboratory. Prerequisite: approval of the instructor. (3Sp)

664 (d484). Tooling for Automation. Design and application of jigs, fixtures, and material handling devices for automated manufacturing. Includes clamping, positioning, nesting, locating, supports, part feeding, inspecting, and orientation selection and rejection. Prerequisite: ITE 352. (3W)

675. Research in Technology Education. To provide teachers, supervisors, and directors of industrial and technical programs with research methods and techniques applicable to their programs. Includes interpretation of various kinds of research. (3F,Su)


682 (d482). Manufacturing Control Systems. Automated manufacturing systems are studied with emphasis on the individual components of the systems and the interactions between components through feedback control systems. Prerequisites: ITE 237, 352, 454, and Math 216. (3Sp)

688. Readings and Conference. Advanced, individualized study on problem selected in consultation with adviser, literature investigation, and progress report at each scheduled conference. (1-3F,W,Sp,Su)

691. Experimental Laboratory in Technology Education. Selection and development of experimental design with tools, equipment, materials, and processes for improving programs and teaching techniques. Accrues to 6 credits for seniors and graduates. (1-3F,W,Sp,Su)

693. Independent Study. (1-6F,W,Sp,Su)®

696. Creative Project. Experience in product development, including a written practicum report of the design, development, and field-test phases. Culminates in partial fulfillment of MS. (1-6F,W,Sp,Su)


699. Continuing Graduate Advisement. (1-3F,W,Sp,Su)®

723. Foundations of Industrial Education. A study of the objectives, legislative foundations, principles, philosophy, impact, and organization of industrial education. (3Su)

746. Industrial Education Finance. Procedures in financial administration of industrial education monies; budget preparation, budget operation and control, and school accounting. (3Su)

781. Research Seminar. Identification of research problems, consideration of research strategies and methods, application of research and statistical concepts in departmental focus, and interaction with faculty. (1-6F,W,Sp,Su)


799. Continuing Graduate Advisement. (1-3F,W,Sp,Su)®

® Repeatable for credit. Check with major department for limitations on number of credits that can be counted toward graduation.

Parenthetical numbers preceded by d indicate a dual listing.
Instructors Deborah Boutwell, library media; Penny Findlay, interactive learning; Nathan M. Smith, Jr., computer applications; Research Associates Leston D. Drake, multimedia design; Mark J. Lacy, multimedia design

Degrees offered: Master of Science (MS), Master of Education (MEd), Educational Specialist (EdS); the Instructional Technology Department participates in the Doctor of Education (EdD) and Doctor of Philosophy (PhD) with a specialization in Instructional Technology

Specializations for MS, MEd, and EdS: Educational Technology, Information Technology and School Library Media Administration, Instructional Development for Training and Education, Interactive Learning Technologies

Instructional technology includes aspects of instructional design and development, communications, product development, electronic distance education, and library and information technology. Instructional technology is a systematic way of designing, implementing, and evaluating the processes of learning and teaching with specific objectives based on research in human learning and communication. It employs a combination of human and non-human resources to bring about more effective instruction. Each aspect of the field has unique contributions to make to the teaching-learning process.

Graduates are in demand in business and industrial settings, as well as in education, because of their preparation in training and instructional design. Admission to the graduate program is open to all students regardless of undergraduate preparation.

Admission Requirements

See general admission requirements, pages 25-26. The MS and MEd admission requirements include a 3.0 GPA for the last 90 quarter credit hours (60 semester credit hours) and an MAT score or GRE verbal and quantitative scores at or above the 40th percentile. In addition, the department requires that those applying for the EdS program have a master's degree, a score at or above the 40th percentile. A minimum of 45 credits beyond the master's degree is required. Additional credits are required for students not having a master's degree in the field.

Degree Programs

Master's Degrees

The specializations for master's degrees are (1) Instructional Development for Training and Education (MS or MEd), (2) Information Technology and School Library Media Administration (MS or MEd), and (3) Educational Technology (MS or MEd).

Instructional Development for Training and Education. This specialization prepares instructional developers to take positions in the human resource development programs in business and industry. It also leads to careers in education, interactive learning technologies, telecommunication, electronic distance education, and adult education.

Preparation in message design, project management, evaluation, computer-assisted instruction, interactive multimedia, product development, and instructional design all add to the professional skills of the instructional technologist. The degree also prepares the student to do advanced graduate work in instructional technology.

Information Technology and School Library Media Administration. The library media center concept is the application of principles of library and information science to all educational materials, equipment, and facilities. The specialization is designed to prepare school library media specialists. The program also qualifies students for State of Utah media certification.

Educational Technology. This specialization is directed to classroom teachers and other educators who feel knowledgeable in their content areas, but would like to apply the principles of educational technology to the teaching/learning process. This may lead to a position as a district or school technology specialist.

Educational Specialist Degree

The Educational Specialist in Interactive Learning Technologies (EdS) is for students interested in acquiring advanced skills in instructional technology beyond those of the master's degree. The program focus is practical and applied rather than theoretical and research-oriented. Students may choose from four areas of emphasis: interactive instructional tool building, advanced interactive multimedia design, adult and distance education, and evaluation. This program involves coursework, independent study, practicum experiences, and a final project. A minimum of 45 credits beyond the master's degree is required. Additional credits are required for students not having a master's degree in the field.

Doctoral Programs (PhD and EdD)

The Instructional Technology Department participates in the Doctor of Education (EdD) and Doctor of Philosophy (PhD) degree program offered through the College of Education. For information about areas of specialization and emphasis of study and research sponsored within them, admission requirements, procedures to follow, and other information, see pages 35-37 of this catalog or contact the department.

Course Requirements

Course requirements for all degrees are dependent upon area of emphasis and are individually planned by the student and the Supervisory Committee.

Financial Assistance

Departmental, grant, assistantship, and other financial support is available and is awarded on a competitive basis. Apply through the department.

Instructional Technology Courses

516. Macintosh Applications for Instruction and Training. Introduction to the use of Macintosh computer applications, with special emphasis on software used in instruction and training for inexperienced users. Prerequisite: computer literacy (3F,W,Sp,Su)
116 Instructional Technology

524. Teaching and Computers. A study of instructional strategies and methods utilized to effectively teach computer literacy in the secondary schools. (3W)

573. Instructional Technology Workshop. Special training and experience in the latest concepts and innovations in instructional technology. Content changes reflecting the most recent topics and problems facing the profession. (1-5S)

580. Independent Study. Individually directed study and projects. Departmental permission required before registration. (1-6F,W,Sp,Su) "

*600 (d500). Providing Information Services. Introduction to the information-providing services of a library media program. Emphasizes reference interviewing, knowledge of basic reference/information sources, and strategies for retrieving information. (3S)

*601. Technology and Its Role in the Transformation of Education. Explores the critical role of educational technology as a process in the transformation of education. (3S)

**602 (d502). Developing Library Media Collections. Building and maintaining collections for library media programs. Discusses policy development, intellectual freedom, and reviewing, evaluating, and selecting materials in all formats. (3S)

**603 (d503). Reading Guidance. Scope of reading programs in media centers. Special problems, interests, tools, and case studies relating to work with children and young people. (3S)

**606 (d506). Organizing and Accessing Information. Considers concepts, policies, and techniques for facilitating access to information in library media centers. Addresses cataloging and classification, and procedures for acquisition, processing, and management. (3S)

**607 (d507). Library Media Center Administration. Includes the study of organization, personnel, budgets, selection, and evaluation of materials and equipment, providing for a wide variety of media services. Prerequisites: Ins T 500/600, 502/602, 503/603, and 515. (3S)

**609 (d509). Information Technology and Automation in Library Media Centers. Includes applications in collections development, circulation, and technical and reference services. Prerequisites: Ins T 500/600 and 506/606. (3S)

**615 (d515). Library Media Programs in the Information Age. Introduction to library media programs for teachers, administrators, and media specialists. Examines the role of media programs in instruction and curriculum. (3S)

**616. Computers in Instructional Technology. Introduction to the use of computers in instructional technology for designing, developing, producing, and managing processes, products, and other resources. (3F,W,Sp)

**617. Design and Development of Microcomputer-Based Instructional Software. Research on instructional software will be reviewed. Human engineering and instructional design concepts will be discussed and utilized in microcomputer software development. (3F,W,Sp)

618. Instructional Simulations. Instructional simulation types and their instructional features; how they integrate within instructional curricula; how they relate to instructional objectives; procedures and principles for their design. (3W)

**619. Multimedia Video Graphics. Fundamental theories and practice of computer-based video graphics and editing systems, such as the Video Toaster/Flyer. (3F,Su)

623 (f523). Computers in Education for Inservice Teachers. Introduction to microcomputer applications in education for inservice teachers. Includes hands-on experiences with computer-assisted instruction, computer-managed instruction, and administrative uses. Taught off-campus only. (1-3F,W,Sp,Su) "

625. Graduate Cooperative Work Experience. Professional level of educational work experience in a cooperative education position for graduate students. (1-1.5F,W,Sp,Su) "

**627. Computer-assisted Instruction Programming: Authoring Languages. Fundamentals of programming computer-based instructional units utilizing the PILOT and other authoring languages. Four- to six-hour weekly lab required. Prerequisite: Ins T 616 or equivalent. (3W,Su)

628. Advanced Authoring Systems. Study of object-oriented authoring tools for computer-based instruction. Implications for the design and production of all CBI forms, including tutorials, simulations, microworlds, and performance support systems. (3Sp)

629. Algorithm Design for Computer-Based Training. Design methods for CBT: designing for re-use, representing content, interaction design, learner navigation, processing learner responses, and hypermedia. Integrates principles of instructional, interface, and program design. (3Sp)

**634 (d534). Instructional Development in Education. In introductory course for teachers and library media specialists, in which students will implement a systems model for identifying of educational problems, developing solution alternatives, evaluation, and revision cycle. (3S)

635. Instructional Development. Introduction to the implementation of systematic instructional development models for education and training, including intervention strategies, needs assessment, analysis, design, product development, implementation, and evaluation. (3F,Su)

*636 (d536). Foundations of Instructional Technology. Considers the present, past, and future of instructional technology, in relation to the individual student developing a personal perspective and understanding of the field. (1-3F,W,Sp,Su) *"}

637. Multimedia Design and Production. Provides students with many of the basic skills required to produce an optical disc-based instructional program. Includes applications of multimedia technologies, design considerations, flow charting, scripting, and evaluation. Class project results in an instructional optical disc. (3W)

638. Interactive Multimedia Technologies. Focuses on advanced multimedia technologies in education and training, repurposing CDROM, optical lasers, and other delivery systems for instruction. (3W,Su)

639 (d539). Field Work. Observation and guided practical experience under professional instructional technology personnel. Bridges the gap between classroom theory and practice in the field. Prerequisite: instructor's consent. (1-3F,W,Sp,Su)

640. Information Technologies for Foreign Language Teaching. Teaching strategies, hardware and software options for video and computer applications in foreign language teaching. (3)

*643 (d543). Slide and Multi-image Design and Development. Theory, planning, design, and production of presentations, involving single and multiple images integrated into an educational learning experience. (3Sp,Su)

**644 (d544). Single Camera Video for Instruction and Training. Use of single-camera video to familiarize students with the properties of the medium to record, edit, and duplicate video programming for education and training applications. (3F,W,Sp)

645 (f731). Instructional Technology Theory and the Learning Process. Introduction to instructional and learning theories as applied to the instructional design process. Examines the principles and research on which instructional design and instructional technology theories are based. (3F,Su)

646. Principles and Practices of Distance Education. Explores the theory, practice, and issues of providing instruction to learners separated by distance. The characteristics, technologies, and design of distance education will be addressed. (3Sp)

648 (d548). Presentation and the Technologies of Instruction. Both proven and new technologies of instruction and presentation examined, while perfecting individual and group presentation skills. Emphasis on competent utilization of a variety of technologies of instruction and training. (3W,Su)

656. Practicum in the Improvement of Instruction. A field-based program focused upon characteristics of effective teaching methodologies, teaching performance, curriculum decision making, value guidelines, and the characteristics of the learner. (1-6) "

*661 (f561). Instructional Technology Communication Theory. Considers communication models, communication barriers, influence of perceptions on learning, strengths and weaknesses of pictorial and verbal modes of presentation. (3F,Su)

*662. Instructional Technology Communication Theory for International Students. Serves as an adjunct course to Ins T 661, giving help for international students, with specific vocabulary and usage patterns for professional work in education. Required for international technology international students for whom English is a second language, concurrent with Ins T 661. (1F,Su)
367. Instructional Technology Program. Designed primarily as an in-service experience for teachers, trainers, administrators, and instructional technology personnel; to improve local programs and services. (1-3) 

367a (F570). Instructional Technology in Education and Training. Offered on request to instructional designers, teachers, administrators, and media personnel who have special needs related to instructional technology and seek assistance in improving their local programs. (3) 

367b (F571). Instructional Technology Workshop. Special training and experience in the latest concepts and innovations in instructional technology. Content changes reflecting the most recent topics and problems facing the profession. (1-6Su) 

367c. Instructional Project Management. Principles of planning, scheduling, allocating resources, budgeting, proposal preparation, cost control, and personnel management for instructional projects. (3Sp) 

367d. Instructional Design. Principles and procedures for instructional design including a variety of instructional design theories and their application to both interactive and conventional formats. (3W) 

**367e. Instructional Product Development.** Methods necessary to research, plan, and produce instructional and/or training materials are presented. Each learner will be required to produce a variety of materials. (3Sp, Su) 

**367f. Instructional Product Evaluation.** An integral part of the production of instructional materials must be their evaluation. This course provides strategies for evaluation at various stages of project completion, to include formative evaluation and product validation. (3W) 

**367g. Implementation and Management of Instructional Training.** Focuses on techniques and methods of putting well-designed instructional training and training into use in both traditional and nontraditional settings. (3Sp, Su) 

681. Research Seminar. Selection of thesis or master’s paper problem in context of departmental interests and selection of appropriate courses to help in carrying out the study. (1F, W, Sp, Su) 

682. CDL: Analysis, Design, and Production. Supervised training and research in the analysis, design, and development phases of instructional courseware. Prerequisites: Ins T 655, 671, and approval of CDL coordinator. (3-9F, W, Sp, Su) 

690. Independent Study. Individually directed study and projects. Departmental permission required before registration. (1-9F, W, Sp, Su) 


694. Internship. An on-campus experience in the department or other centers/programs in which the student applies knowledge gained in the graduate program. May be used as culminating experience for the MS, Plan C. (3-9F, W, Sp, Su) 

695. Externship. Students select an appropriate externship with an off-campus business, education, or government agency. May be used as culminating experience for the MS, Plan C. (3-9F, W, Sp, Su) 

696. Creative Project. Individual experience in instructional product development, including a report of the process. Culminating experience for the MEd degree. May also be used as culminating experience for the MS, Plan C. (3-9F, W, Sp, Su) 


699. Continuing Graduate Advisement. (1-12F, W, Sp, Su) 

705. Internship in Program Evaluation. Experience in practical aspects of program evaluation through planned, supervised evaluation project participation approved by the student’s supervisory committee. (1-6F, W, Sp, Su) 

706. Internship in Research. Experience in conducting research through planned, supervised research project participation approved by the student’s supervisory committee. (1-6F, W, Sp, Su) 

738. Current Issues Seminar. Explores impacts of interactive learning technologies in Western countries and in the developing world in the dimensions of (1) current practice, (2) theory, and (3) policy. (3F, W, Sp, Su) 

744. Instructional Technology Research and Development. Advanced study of research which supports instructional development theory, practices, and procedures, including content structure, course organization, course sequence, and instructional strategies. (3Sp) 

781. Research Seminar. Identification of research problems, consideration of research strategies and methods, application of research and statistical concepts in departmental focus, and interaction with faculty. (1F, W, Sp, Su) 

782. Instructional Research Review Practicum. Supervised instructional research review, providing “real world” critique or synthesis; not merely a literature review resulting in a professional paper appropriate for publication in a professional journal. Ins T 781 must be taken concurrently. (3-9F, W, Sp, Su) 


784. Instructional Empirical Investigation Practicum. Investigation of a general question or hypothesis. Students design, collect, and analyze data, and report on an empirical investigation. Ins T 781 must be taken concurrently. (3-9F, W, Sp, Su) 

785. Instructional Evaluation Practicum. Design and evaluation of an instructional product or process. Acceptable empirical evaluation methodology may be used. Must include data collection and analysis. Ins T 781 must be taken concurrently. (3-9F, W, Sp, Su) 

786. Funding Proposal Practicum. Preparation of project funding proposal for submission to a funding agency. Ins T 781 must be taken concurrently. (3-9F, W, Sp, Su) 

790. Independent Study. (1-5F, W, Sp, Su) 


792. College Teaching Seminar. Develops skills and knowledge necessary for college teaching. Activities are designed to help participants in two areas: (1) course development and (2) presentation skills development. (1-3) 

796. Practicum. Experience in product development including a written practicum report of survey of literature, design development, and formative evaluation phases. Culminating project in partial fulfillment of EdS requirements. (1-12F, W, Sp, Su) 

797. Dissertation. Individual work on research problems in the EdD and PhD programs. (1-18F, W, Sp, Su) 

799. Continuing Graduate Advisement. (1-12F, W, Sp, Su)
Department of

Landscape Architecture and Environmental Planning

College of Humanities, Arts and Social Sciences

Acting Head: Associate Professor Vern J. Budge, landscape construction, recreation planning
Office in Fine Arts Visual 230, 797-0501

Graduate Program Coordinator: Professor Craig W. Johnson, planting design, land rehabilitation, wildlife habitat design

Professors Jerry W. Fuhriman, design, graphics; Richard E. Toth, landscape analysis, design theory; water resources planning; Associate Professors John C. Ellsworth, visual resource management, computer applications; John K. Nicholson, urban and regional planning; Michael L. Timmons, site planning and history of landscape architecture; Assistant Professors David Bell, residential and urban design; Laura R. Massirchio, site analysis and wetland restoration; Adjunct Assistant Professors Dale J. Blahna, Forest Resources Department; Mark W. Brunson, Forest Resources Department; Robert H. Schmidt, Fisheries and Wildlife Department

Affiliated Faculty: The following individuals maintain an active association with the department through studio presentations, guest lectures, seminars, serving as members of thesis committees, and Environmental Field Service projects.

Professors John A. Kadlec, Department of Fisheries and Wildlife; John E. Keith, Department of Economics; Richard S. Kranich, Department of Sociology, Social Work and Anthropology; James A. MacMahon, Dean, College of Science

Degrees offered: Master of Landscape Architecture (MLA), Master of Science (MS) in Town and Regional Planning


The Department of Landscape Architecture and Environmental Planning offers two graduate degrees: Master of Landscape Architecture and Master of Science in Town and Regional Planning. The Master of Landscape Architecture degree is fully accredited. The department also offers a fully accredited undergraduate program in landscape architecture.


Master of Landscape Architecture

The program for the Master of Landscape Architecture (MLA) emphasizes both traditional subjects of the discipline and emerging areas of the profession such as large-scale landscape analysis, visual assessment, and land systems design using computer-aided techniques.

The department offers two MLA programs: one for students who have previously earned baccalaureate degrees in landscape architecture from accredited programs and the other for individuals from other disciplines who would like to earn an MLA degree.

MLA—Advanced Professional Degree. The MLA—Advanced Professional Program is a two-year program of study. Applicants must hold baccalaureate degrees in landscape architecture from accredited programs. The advanced program allows outstanding students to expand their knowledge in areas of special interest under the supervision of a major professor and supervisory committee.

Course of Study. A major professor, whose interests are closely aligned to those of the student (see Areas of Specialization), will supervise thesis work. A minimum of 45 graduate-level credits, including 9 credits of thesis work, is required. Students supplement requirements with courses recommended by the major professor and supervisory committee.

Core Courses. The core courses for the two-year program are as follows:

First year: fall quarter: LAEP 610, 674, 686, and 691; winter quarter: LAEP 611, 687, 692, and FW 386; spring quarter: LAEP 612, 675, 688, 693, FW 527, and Phil 327. In addition, students take 3 credits of recommended courses in the area of specialization fall quarter.

Second year: fall quarter: 3 credits of LAEP 697, 3 credits of required 500- or 600-level courses in area of specialization, and 3 elective credits; winter quarter: 3 credits of LAEP 690 and 3 credits of recommended electives in the area of specialization; spring quarter: 3 credits of LAEP 690.

MLA—First Professional Degree. A three-year program leading to the MLA is available for candidates with previous baccalaureate degrees in fields other than landscape architecture. The core curriculum comprises a one-and-a-half year lecture and studio sequence designed to prepare the student in fundamental professional skills.

The department requires a minimum of 45 graduate-level credits, including at least 9 credits of work on a thesis. An outside area of specialization may be pursued by...
Financial Assistance

Application deadline for scholarship consideration is February 1. Acceptance to pursue graduate study does not guarantee the student financial assistance.

Career Opportunities

The Department of Landscape Architecture and Environmental Planning provides education for careers in site planning, design, and management of town, rural, and wilderness environments of the West. Graduates are employed by local, state, and federal agencies, as well as by private sector professional firms. LAEP graduates also find employment in academia at both the undergraduate and graduate levels.

Landscape Architecture and Environmental Planning Courses

610. Regional Planning Theory and Inventories. Case studies and computer-assisted inventory of data for a major planning project or issue. (5F)

611. Regional Planning Analysis. Continues LAEP 610 with computer-assisted analysis of data and generation and evaluation of planning alternatives. (5W)

612. Regional Planning Policy and Implementation. Design of implementation strategies for planning alternatives developed in LAEP 611. (55p)

616. Professional Practice. Graduate readings and reports on current topics and trends in landscape architecture and environmental planning. Registration by permission only. (2W)

625. Internship and Cooperative Education Program. Course credit for professional experience outside the classroom prior to graduation. A statement of professional goals and a summary report following the experience are required. (1.5)®

674. Planning Methods. Analytical methods and planning techniques which are commonly used in planning, landscape architecture, and research offices. Projects will require the application of the methods learned. (3W)

675. Implementation and Regulatory Techniques in Planning. An analysis of techniques utilized to implement the comprehensive plan. Major topics include zoning, capital improvements, subdivision regulations, code enforcement, and growth controls. (35p)

686. Seminar. Landscape architecture and planning program options and research potential. (1F)

687. Seminar. Review of interdisciplinary resources within the University. (1W)


690. Special Problems. Selected problems to meet individual student interests and areas of concentration. Registration by permission only. (1-6F,W,Sp,Su)®

691. Readings in Landscape Perception. Graduate readings seminar. (1F)

692. Readings in Creativity and Design Process. Graduate readings seminar. (1W)

693. Readings in Landscape Design and the Context of Culture. Graduate readings seminar. (15p)

697. Thesis Research. (1-10F,W,Sp,Su)

699. Continuing Graduate Advisement. (1-3F,W,Sp,Su)®

® Repeatable for credit. Check with major department for limitations on number of credits that can be counted for graduation.
Department of

Management and Human Resources

College of Business

Head: Professor John R. Cragun, organizational behavior and human resources
Office in Business 411, 797-2787

Graduate Program Director: John R. Cragun, organizational behavior and human resources

Professors Gary B. Hansen, manpower economics, industrial relations; Leon R. McCarrey, management; Glenn M. McEvoy, human resources, organizational behavior, management; Y. Krishna Shetty, management and business strategy; David B. Stephens, business strategy and labor relations; Professors Emeritus Vernon M. Buehler, Howard M. Carlisle, Richard L. Smith; Associate Professors Caryn L. Beck-Dudley, business law, employment law, and social responsibility; David R. Daines, business law, employment law, and social responsibility; Steven H. Hanks, business strategy, management, and entrepreneurship; Ross E. Robson, human resources and social responsibility; Adjunct Associate Professor Val R. Christensen, organizational behavior; Assistant Professors David A. Baucus, business strategy, management, and entrepreneurship; Melissa S. Baucus, business strategy, management, social responsibility, and organizational behavior; Gaylen N. Chandler, human resources, management, entrepreneurship; Senior Lecturers Lawrence H. Siebers, executive in residence, management, human resources, and social responsibility; Sharon Tarnutzer, graduate adviser, management and human resources

Degree offered: Participates in Master of Social Sciences (MSS)

Specialization: Human Resource Management (HRM)

For additional information on the MSS, see Interdepartmental Program in Social Sciences (pages 41-42).

The department also participates with other departments in the College of Business in offering the Master of Business Administration (MBA) Degree. A description of the MBA degree and program requirements can be found in the Interdepartmental Curricula section of this catalog (see pages 37-39). Graduate-level courses offered by the department are included in the plans of study of graduate students in a wide variety of disciplines.

The MSS is an interdisciplinary degree involving social science courses designed to provide breadth in content and the perspective of the social and work environment in which people operate. The emphasis of Human Resource Management deals with those processes which provide, develop, and maintain a productive work force. Subject areas include human resource planning, recruiting, selection, placement, benefits and compensation, performance management, career planning, training and development, labor/management relations, and ethical/legal employment practices.

A dynamic and changing work environment within an increasingly complex social environment provides unique challenges and opportunities for students in this discipline. One focus of this degree is to prepare students for professional certification by the Human Resource Certification Institute. The director of the MSS/HRM program has information on the institute and its accreditation designations. The program is designed to provide a balance between meeting the professional goals of students, while at the same time ensuring coverage of the Human Resource Management discipline.

One of the structured options in the program allows students to focus on Student Services Personnel Administration, which helps prepare students for employment in student-related functions at two- and four-year colleges and universities, as well as vocational centers and technical schools.

Admission Requirements

See Admission Procedures on pages 25-26. Students are required to submit scores on either the Graduate Record Examination (GRE) or the Graduate Management Admissions Test (GMAT). Prospective students may request information on the expected test performance standards for acceptance. Applicants are expected to have strong written and oral communication skills.

This program is open to students with a variety of undergraduate majors. However, students who have specialized in human resources at the undergraduate level should see the program director for advisement.

Students are expected to be admitted to the program as matriculated students before taking coursework leading to the degree. However, to accommodate unique situations which exist with some prospective students or individuals who may simply be interested in the course content, students may be permitted to take a class providing space is available and written permission is obtained from the Director of the MSS/HRM Graduate Program. A letter explaining reasons and intentions must be submitted by the student making the request.

Degree Requirements

Students are held responsible for meeting requirements as outlined in the Graduate Catalog. Requirements specific to this degree are outlined below. It is the
students responsibility to be aware of all requirements and initiate the resolution of apparent inconsistencies.

The typical degree option is Plan C, which includes coursework to meet the degree requirements. The student should consult with the MSS/HRM Program Director if the Plan B option is being considered.

A minimum of 51 credit hours is required for the degree. Under Plan C, no thesis credit is allowed. The required core courses include a capstone course which meets the requirement of a Plan C culminating experience. A maximum of three credits may be earned either from readings/conferences or from independent research. A maximum of three hours of supervised internship credit is also permitted. At least 24 credits, and no more than 25 credits, can be taken from the MHR Department. A minimum of 12 credits in each of two cooperating minor disciplines, or 12 credits in a cooperating minor and a minimum of 12 credits in a cluster, is required. A cluster is a grouping of courses outside of the major and the minor which is complementary to the degree and which meets the professional goals of the student. All clusters must be approved by the Program Director. In some instances, a minor from a discipline other than the cooperating minor disciplines may be approved. No more than six credits of 300 and 400 level courses will be acceptable in a student's program.

Required courses include: MHR 609, 655, 661, 663, 667, 669, 676, Econ 522; Econ 666 or BIS 635; Soc 312 or Econ 633; and Soc 610 or Psy 601. If a student has taken a comparable course, an acceptable substitute may be approved by the Director of the MSS/HRM Graduate Program.

Financial Assistance and Assistantships

A limited number of graduate assistantships, scholarships, and other departmental awards are provided to outstanding students on a competitive basis. Acceptance to the program does not guarantee financial assistance. Application forms are available from the MHR Department and should be submitted prior to April 1.

Additional Information

Additional information may be obtained by contacting the Department of Management and Human Resources.

Management and Human Resources Courses

600. Survey of Business Law. A detailed investigation of the law and business, especially the application of state and federal laws to free enterprise and business operations. The law involved in business transactions. Also taught in Ogden.2 (3Sp)

601 (d501). Advanced Business Law. A detailed investigation of business law, including the law of contracts, torts, property, secured transactions, commercial paper, and business organizations. Prerequisite: MHR 299. (4Sp)

609. Survey of Management and Organizational Behavior. Survey of management concepts and the human aspects of administration. Deals with leadership concepts and management processes relating to decision making, planning, controlling, and interpersonal relations. Also taught in Ogden and over COMNET.2 (4F)

625. Graduate Internship. A career-related internship for students wishing to develop or expand their occupational experience. (1-6F, W, Sp, Su)

655. Human Resource Planning and Staffing. Role of human resource planning in determining staffing needs of organizations. Topics include developing candidate specifications, recruitment, assessment, decision making, and compliance with laws and regulations. A basic course in statistics is recommended. Also taught in Ogden and over COMNET.2 (3F)

661. Performance Management. The design and implementation of performance management systems, including job analysis, performance appraisal, legal issues, employee discipline, and relationship to business strategy. Also taught in Ogden and over COMNET.2 (3F)

662. Human Resources Management. Personnel topics relevant to all managers: human resources as strategic assets, managing human resource flows, administering rewards, and structuring employee influence systems. Also taught in Ogden.2 (3W)

663. Compensation and Benefits. Analysis of compensation and benefits policies and programs, job evaluation systems, job pricing, wage and salary surveys, administration, and other related issues. A basic course in statistics is recommended. Also taught in Ogden and over COMNET.2 (3W)

684 (d564). Selected Topics in Management and Human Resources. Selected topics in management and/or human resources are pursued in depth. Topics and instructor may vary. Prerequisites: senior or graduate standing, approval of instructor. (1-4)

685. Interpersonal Effectiveness in Management. An experiential course designed to develop specific managerial skills which contribute to interpersonal completeness and effectiveness in work groups. Also taught in Ogden.2 (3Sp)

686. Organizational Leadership, Influence, and Change. Exploration of leadership, power, and change in organizations. Emphasis is on application of concepts through cases, exercises, or other activities. Prerequisite: MHR 681. Also taught in Ogden.2 (3F)

687. Labor Relations. Seminar in the theory of the labor movement and the role of labor in today's industrial society. Prerequisite: MHR 699 (or equivalent). Also taught in Ogden and over COMNET.2 (3Sp)

690. Human Resource Policy and Strategy. Capstone course designed to integrate HR concepts. Strategic and international applications of HR are considered. Prerequisite: completion of HR functional courses. Also taught in Ogden and over COMNET.2 (3Sp)

696. Professional Paper. A paper of professional quality prepared by each student. Designed to demonstrate the ability to complete a major business-related project and to effectively present the results. Also taught in Ogden.2 (3W)

699. Continuing Graduate Advisement. (3F, W, Sp, Su)
Department of Mathematics and Statistics
College of Science

Head: Professor Jerry Ridenhour, differential equations
Office in Lund Hall 220, 797-0244

Director, Graduate Studies: Associate Professor Zhi Qiang Wang, nonlinear differential equations, nonlinear analysis
Office in Lund Hall 221, 797-0244

Professors Ian M. Anderson, differential geometry, global analysis; LeRoy B. Beasley, matrix theory, linear algebra, combinatorics; Ronald V. Canfield, multivariate and industrial statistics; James S. Cangelosi, mathematics education; Laurence O. Cannon, topology, mathematics education; Chris S. Coray, numerical analysis; Lance L. Littlejohn, differential equations, special functions; L. Duane Loveland, geometric topology, continuum theory; Renate Schaar, nonlinear differential equations; Donald V. Sisson, statistical methods, experimental design; Russell C. Thompson, differential equations; Homer F. Walker, numerical analysis, applied mathematics; Stanley C. Williams, measure theory, modern analysis; Michael P. Windham, cluster analysis, robust estimation; Professors Emeriti Joe Elich, mathematics education; Konrad Suprunowicz, analysis; David White, categorical data analysis; Associate Professors Adele Cutler, statistical computing; Richard Cutler, experimental design, robust statistics; E. Robert Heat, analysis, statistics, mathematics education; Kevin Hester, applied probability; Joseph V. Koebbe, numerical analysis, applied mathematics, computational fluid dynamics; Kathryn Turner, numerical analysis, optimization, linear algebra; E. Eugene Underwood, matrix theory, linear algebra; Associate Professors Emeriti Robert G. Hammond, mathematics education; Mary Nelson; Wayne R. Rich, mathematics education; James D. Watson, numerical analysis; Assistant Professors Daniel C. Coster, experimental design, linear models; Michael C. Minnott, nonparametric density estimation, statistics; Daniel K. Nakano, algebra, James Powell, applied mathematics, mathematical biology; Emily Stone, dynamical systems; Xiadong Zheng, computer-intensive methods, statistical model selection, nonparametric statistics

Degrees offered: Master of Science (MS) in Mathematics and in Statistics; Master of Mathematics (MMath); Doctor of Philosophy (PhD) in Mathematical Sciences

Specializations: PhD—College Teaching, Interdisciplinary Studies, Pure and Applied Mathematics, Statistics

Admission and Application Requirements

See general admission requirements, pages 25-26. All students expecting matriculation in mathematics or statistics should have completed at least a BS degree in mathematics or statistics or have a degree in a closely related field with extensive coursework in one of the departmental disciplines.

Master's Degree Programs

The MS degree program has thesis and report options, as well as a coursework-only option. All three options require 45 credits of approved coursework at or above the 500 level. At least 27 of these credits must be at or above the 600 level, excluding 699 (continuing graduate advisement). The thesis option includes up to 9 credits and the report option 3 credits of Math 697 or Stat 697. A cumulative graduate GPA of at least 3.0 is required for graduation. No course with less than a B- may be counted. The coursework-only option requires no thesis or report.

The departmental graduate committee supervises MS students until a director is found for the thesis or report, at which time a new supervisory committee is appointed. Prior to approval of candidacy, students in the thesis or report option must pass an examination in English writing. This exam is created and administered by the department.

The MMath is designed for current or prospective secondary or community college teachers of mathematics. The program requires at least 48 credits approved by the department graduate committee. At least 33 of these 48 credits must be from math courses numbered above 500. Math 461 or an approved substitute must be included. The GPA for the 48 credits and the GPA for the 53 math credits above 500 must be at least 3.0. Students entering the program must either possess a valid secondary school teaching certificate or be concurrently enrolled in a certification program.

Both master's programs require successful completion of a written qualifying examination. For mathematics students, the exam covers the advanced calculus sequence (Math 420, 521, 522, 523). For statistics students, the exam covers the probability and statistics courses Math 571, 572, and 573 and Stat 301, 502 and 503. Graduate students must take the exam not later than the June session at the end of the first full year of matriculation. Students may take the exam before beginning formal coursework. The exam is normally given twice a year, in June and in September. Matriculated students failing on the first try must pass the exam at the next scheduled opportunity. A complete exam syllabus is available from the department.

PhD Programs

The PhD in Mathematical Sciences provides a student with four specializations for graduate study: (1) College Teaching, (2) Interdisciplinary Studies, (3) Pure and Applied Mathematics, and (4) Statistics.
The College Teaching Specialization is designed to prepare the student to teach undergraduate mathematics in two- and four-year colleges and in universities. This program is less specialized than the other two options. Students in the College Teaching option receive broad training in pure and applied mathematics. The dissertation for this option includes exposition of important mathematical theorems and their historical relationships in an area of mathematics of the student's choosing.

The Interdisciplinary Studies Specialization combines advanced training in mathematics with another field that uses advanced mathematics as a research tool. The mathematical component emphasizes areas of applied mathematics. In addition, the student receives graduate-level training in the chosen area of application. The student's course of study and research is directed both by scholars in mathematics and by scholars in the related discipline. The dissertation involves the development and application of mathematics in the context of research problems arising in the chosen interdisciplinary area.

The Pure and Applied Mathematics Specialization is a traditional doctoral program in mathematics, offering broad training in the foundations of modern mathematics together with specialized training in an area of mathematical research. The dissertation represents a significant contribution to mathematics research in the chosen area of specialization.

The Statistics Specialization offers broad training in theoretical and applied statistics for students seeking careers in academia, industry, or government. The dissertation represents a significant contribution to statistical research.

In all the doctoral specializations a course of study consists of 135 credits beyond a bachelor's degree or 90 credits beyond a master's degree. The minimal course requirements described below assume that the student needs 135 credits. In all specializations, credit may be earned toward a master's degree, as part of the 63 required credits (see below), but coursework cannot be applied to two degrees. The complete course of study must be approved by the student's supervisory committee.

Course Requirements

College Teaching Specialization. Seven course sequences (63 credits) in mathematics courses numbered 600 and above, excluding Math 797 and including at least 9 credits in seminars and topics courses in mathematics at the 700 level, and 6 credits of Math 791 (Teaching Internship), are required.

Interdisciplinary Studies Specialization. Sixty-three (63) credits in courses numbered 600 and above, excluding Math 797 and including at least four course sequences (36 credits) in mathematics, 9 credits in seminars and topics courses in mathematics at the 700 level, and approved courses in the student's interdisciplinary area, are required.

Pure and Applied Mathematics Specialization. Seven course sequences (63 credits) in mathematics courses numbered 600 and above, excluding Math 797 and including at least 9 credits in seminars and topics courses at the 700 level, are required.

Statistics Specialization. Seven course sequences (63 credits) in mathematics or statistics in courses numbered 600 and above, excluding Math 797 and Stat 797 and including at least 9 credits in seminars and topics courses at the 700 level, are required.

For all students in the Pure and Applied Mathematics, the Interdisciplinary Studies, and the Statistics specializations a maximum of 45 credits of Math 797 (Dissertation Research) is allowed. Students in the College Teaching Specialization are allowed a maximum of 30 credits of Math 797.

Besides the coursework described, the general requirements for the PhD include:

1. Competency in advanced calculus.
2. Competency in a foreign language.
3. Passing three written comprehensive examinations. The exams are given in June and September. Some latitude in subject is permitted, although all students in mathematics must pass an examination in real analysis. All comprehensive exams in mathematics and statistics must be passed within a single 13-month period. This period begins with the first sitting for such an examination but may not begin later than the September following the first full academic year as a matriculated PhD student. Students are encouraged to sit for all three exams within a 7-day period, but sitting for fewer is permitted. A student need not repeat exams already passed. For the Statistics Option, all students must pass three written exams, two of which must be examinations in probability, linear models, or mathematical statistics.
4. Completion of an examination in English writing.
5. Completion of a dissertation.
6. Passing a final oral examination defending the dissertation and demonstrating a general knowledge of mathematics.

Research

Mathematics research opportunities within the department are many and varied, and students are urged to contact faculty about mutual interests at as early a stage as feasible. The interdisciplinary option permits and encourages study with a broad spectrum of outstanding nationally recognized University research programs.

Financial Assistance

The department offers full-time teaching assistantships, half-time paper-grading assistantships, research fellowships, and work study assistance for students in all graduate degree programs. Stipends vary from $5,800 for a half-time paper-grading assistantship to $10,300 for beginning teaching assistants. Normally, a teaching assistant has responsibility for a single course each quarter. Stipend amounts are increased by $1,000 when the student completes the PhD comprehensive examinations. Out-of-state tuition waivers are usually given with each full-time teaching or half-time paper-grading assistantship. Applications for teaching assistantships should be mailed by March 1 of each year.
Mathematics Courses

521, 522, 523. Advanced Calculus. One and several variable calculus from an advanced point of view, topology of Euclidean n-space, sequences of functions. Prerequisite: Math 420 or 551. (3F) (3W) (3Sp)

527, 528, 529. Introduction to Complex Variables. Basic theory and applications of complex variables for mathematics, physics, and engineering students. Analytic functions, contour integrals, conformal mappings, transform theory, special functions. Prerequisites: Math 320, 321, 322. (3W) (3Sp) (3F)

531, 532, 533. Modern Algebra. Fall quarter: introductory group theory. Winter and spring quarters: rings, fields, and representations. Prerequisites: Math 320, 321, 322. (3F) (3W) (3Sp)

534, 535. Linear Algebra. Vector space theory, linear transformations and matrices, eigenvalues and eigenspace theory, inner product spaces, orthogonality, generalized eigenvectors, Jordan canonical form, minimal polynomial. Prerequisite: Math 531. (3W) (3Sp)

541. Methods of Applied Mathematics I. Dimensional analysis, Buckingham Pi theorem, regular and singular perturbation theory, boundary layer analysis, introduction to calculus of variations. Prerequisite: Math 322. (3F)


543. Methods of Applied Mathematics III. Integral equations, stability and bifurcation analysis, and/or other topics. Prerequisites: Math 322 and 542. (3Sp)

546. Introduction to Theory and Application of Nonlinear Dynamical Systems. Understanding the long-term behavior of nonlinear dynamical systems as system parameters and initial states vary. Prerequisites: Math 521, 522. (3Sp)

551, 552, 553. Introduction to Topology. Elementary point set topology with emphasis on linearly ordered and metric spaces. Prerequisite: Math 222. (3F) (3W) (3Sp)

557, 558, 559. Actuarial Mathematics. An introduction to the theory of risk and its application to the construction and analysis of models for insurance systems. Prerequisites: Math 573 and consent of the instructor. (3F) (3W) (3Sp)

561. Numerical Analysis I. Direct solution of linear systems, Gaussian elimination with pivoting, Cholesky decomposition, QR factorization, power and GR methods for eigenvalues, solution of nonlinear scalar equations. Prerequisite: Math 321. (3F)

562. Numerical Analysis II. Newton methods for nonlinear systems, numerical differentiation, numerical quadrature, interpolation. Prerequisite: Math 561. (3W)

563. Numerical Analysis III. Numerical solution of ordinary and partial differential equations, shooting methods, finite differences. Includes initial and boundary value problems, stiff equations, and parabolic and elliptic PDE. Prerequisite: Either Math 561 or 542. (3Sp)

564, 565, 566. Applied Optimization. Theory and practical issues associated with algorithms for constrained and unconstrained optimization. Prerequisites: Math 320, 521, and 461 or equivalent. (3F) (3W) (3Sp)

571. Theory of Probability. Basic mathematical theory of probability, discrete and continuous random variables. Prerequisites: Math 320, 321, 331. (3F)

572, 573. Introduction to Mathematical Statistics. Basic mathematical theory of point estimation, interval estimation, hypothesis testing, and linear models. Prerequisite: Math 571. (3W) (3Sp)

577. Introduction to Stochastic Processes. Application of stochastic processes to engineering and science. Topics include Markov chains, Poisson processes, renewal theory, and Brownian motion. Prerequisite: Math 571. (3W) (3Sp)

581, 582, 583. Topics in Mathematics. Prerequisites: Math 320, 521, and 322. (1-3F) (1-5W) (1-5Sp)

591. Readings and Conference. Registration requires prior arrangements with instructor. (1-4F, W, Sp, Su)

595H. Honors Senior Project. A senior project, required for completion of the departmental honors program and developed under the direction of a departmental faculty member. Prerequisite: Math 522. (1-4F, W, Sp)

600. Graduate Internship/Co-op. (1-6F, W, Sp, Su)

611, 612, 613. Differential Geometry. An introductory course in modern differential geometry. Topics include manifolds, calculus on manifolds, tensor calculus and differential forms, Lie groups, Riemannian geometry, deRham's Theorem, and Hodge theory. Prerequisite: Math 523. (3F) (3W) (3Sp)

621, 622, 623. Real Analysis. This course will include a detailed study of Lebesgue measure and integration theory, applications of topology to analysis, and an introduction to functional analysis. Prerequisite: Math 523 or consent of instructor. (3F) (3W) (3Sp)

631, 632, 633. Modern Algebra. An advanced treatment of algebraic structures, including semigroups, groups, rings and ideals, integral domains, fields, and Galois theory. Prerequisites: Math 531, 532, and 533. (3F) (3W) (3Sp)

634, 635, 636. Matrix Theory and Linear Algebra. Multilinear functionals, eigenvalues, eigenvectors, singular values, similarity, equivalence, normal matrices, canonical forms, vector and matrix norms, non-negative matrices. Prerequisites: Math 531, 532, and 533. (3F) (3W) (3Sp)


644, 645, 646. Partial Differential Equations. Introduction to the linear theory of partial differential equations as it applies, for example, to models of heat flow, vibrating membranes, or gas dynamics. Prerequisites: Math 621, 622, 623. (3F) (3W) (3Sp)

651, 652, 653. Topology. Basic topological concepts; topics generally include the separation axioms, product and identification spaces, basic homotopy theory, fundamental groups, metrization theorems, and fixed point theorems. Prerequisite: Math 553 or consent of instructor. (3F) (3W) (3Sp)

661, 662, 663. Numerical Analysis. Prerequisites: Math 523, 536. (3F) (3W) (3Sp)

664, 665, 666. Optimization. Topics covered include problem formulations, optimality criteria, a survey of standard theoretical and numerically implementable optimization techniques. Promising new techniques/applications may be introduced. Prerequisite: Math 523. (3F) (3W) (3Sp)

671, 672, 673. Probability Theory. Probability spaces, random variables, distribution functions, expectations, independence, laws of large numbers, and the central limit theorem. Applications to stochastic processes, stochastic modeling, statistics, and other areas of mathematics. Prerequisite: Math 523. (3F) (3W) (3Sp)

681, 682, 683. Topics in Mathematics (Topic). (3F) (3W) (3Sp)


699. Continuing Graduate Advisement. (1-3F, W, Sp)

711, 712, 713. Topics in Geometry. (3F) (3W) (3Sp)

721, 722, 723. Topics in Analysis. (3F) (3W) (3Sp)

731, 732, 733. Topics in Algebra. (3F) (3W) (3Sp)

741, 742, 743. Topics in Differential Equations. Prerequisite: Consent of instructor. (3F) (3W) (3Sp)

751, 752, 753. Topics in Topology. (3F) (3W) (3Sp)

761, 762, 763. Topics in Numerical Analysis. (3F) (3W) (3Sp)

764, 765, 766. Topics in Optimization. (3F) (3W) (3Sp)

771, 772, 773. Topics in Probability and Statistics. (3F) (3W) (3Sp)

780. Seminar. (1-3F, W, Sp)

781, 782, 783. Topics in Mathematics. (3F) (3W) (3Sp)

785, 786, 787. Topics in Applied Mathematics. (3F) (3W) (3Sp)

791. College Teaching Internship. Supervised college teaching experience for the college teaching option. Prerequisite: consent of instructor and department head. (3F, W, Sp)


799. Continuing Graduate Advisement. (1-3F, W, Sp)
Statistics Courses
502. Statistical Methods II. Differences between means and proportions, chi-squared tests, linear regression, analysis of variance, and mean comparisons. Prerequisite: Stat 501 or equivalent. (3F,W,Sp,Su)

503. Statistical Methods III. Two-way and three-way analyses of variance, covariance, and multiple regression. Prerequisite: Stat 502. (3W)


510. Sampling. Random sampling, sampling for proportions, stratified sampling, cluster sampling. Emphasis will be placed on applications. Prerequisite: Stat 502. (3W)

515. Categorical Data Analysis. Analysis of categorical data. Continency tables; goodness of fit; work of Goodman, Kullback; Markov chains; use of computer programs. Prerequisite: Stat 503 or 605/605. (3F)

520. Design of Experiments. The design, analysis, and interpretation of experiments, especially factorials, split plots, incomplete blocks, confounding, fractional factorials, and nested designs. Prerequisite: Stat 503 or equivalent. (3Sp)

532. Applied Time Series. An introduction to time series analysis and signal processing. Topics include trend analysis, ARIMA models, seasonal models, forecasting, spectral analysis, and filtering. Prerequisite: Stat 503 or 605/605. (3W)

560. Applied Multivariate Statistics. An introduction to multivariate statistical procedures for data analysis. Topics include MANOVA, principal components analysis, factor analysis, discriminant analysis, clustering, and classification. Prerequisite: Stat 503 or Stat 605/605. (3F)

581, 582, 583. Topics in Statistics. Prerequisite: Stat 502. (1-5F-1-5W) (1.5Sp)

595H. Honors Senior Project. A senior project, required for completion of the departmental honors program and developed under the direction of a departmental faculty member. Prerequisite: Stat 503. (1-4F, W, Sp)


605 (565). Linear Regression. Methods for prediction and hypothesis testing in multi-variate linear models, including analysis of variance and covariance. Statistical software for regression and ANOVA. Prerequisite: Stat 502 or 230. (3Sp)

615. Nonparametric Statistics. The nature and importance of non-parametric procedures. Non-parametric test of hypothesis commonly encountered in statistical applications is considered. Prerequisite: Stat 503 or 605/605, and Math 573. (3F)

616. Reliability. Common survival distributions and associated hazard rates including point and interval estimation and testing procedures; accelerated life test designs and analysis; series, parallel, K out of N, maintained and non-maintained systems. Prerequisite: Math 573. (3W)


625. Graduate Internship/Co-op. Education work experience at the graduate level. (1-12)

634. Analysis of Unbalanced Data. The analysis of messy data. Two- and three-factor analyses, different dummy variables, codings, unbalanced split plots, multiple comparisons, expected mean squares, and general analysis of covariance. Use of canned statistical packages. Prerequisite: Stat 529. (3F)

635. Linear Statistical Models. The theory and methods of correlation, regression, and least squares analysis of experimental data. Prerequisites: Math 573 and Stat 503 or 605/605. (3W)

636. Linear Statistical Models. Linear models as applied to analysis of variance and covariance problems. Prerequisite: Stat 505. (3Sp)

642. Time Series. Time domain and frequency domain time series analysis including Box-Jenkins methods, spectral analysis and filtering, introduction to state space methodology. Prerequisites: Math 573 and Stat 605/605. (3Sp)

660, 661. Multivariate Analysis. The multivariate normal, wishart, and Hotelling’s T2 distributions. Multivariate regression and manova. Principal components and factor analysis, multidimensional scaling, classification, and cluster analysis. Prerequisites: Math 573 and Stat 503 or 605/605. (3F, 3W)

675. Practical Statistical Consulting. Discussion of actual problems encountered through consulting. (2)

681, 682, 683. Topics in Statistics. Prerequisite: Stat 502 or consent of instructor. (3F, 3W) (3Sp) Repeatable for credit.

695. Readings and Reports. Individual study and report preparation in areas of special interests. Training in professional consulting. (3-6F, W, Sp, Su)


699. Continuing Graduate Advisement. (1-3F, W, Sp, Su)

701, 702, 703. Topics in Mathematical Statistics. Local asymptotic minimax and best asymptotic normal theories of optimality and robustness, minimum distance estimation. (3F) (3W)

704, 705, 706. Topics in Decision Theory. Advanced, measure theory-based decision theory. (3F) (3W)

720, 721, 722. Topics in Experimental Design. Optimal design for approximate and exact designs, construction results, response surface methods. (3F) (3W)

734, 735, 736. Topics in Statistical Modelling. Dynamic linear models, the Kalman filter, state space models, splines and various kinds of non-linear models. (3F) (3W)

751, 752, 753. Topics in Computational Statistics. Projection-pursuit, optimization in statistical problems, the E-M algorithm, algorithms for multivariate procedures. (3F) (3W)

760, 761, 762. Topics in Multivariate Statistics. Mixture models, classification, and cluster analysis. General theory, algorithms, and asymptotics. (3F) (3W)


*Taught 1995-96.
**Taught 1996-97.

**Taught 1995-96.

© Repeatable for credit. Check with major department for limitations on number of credits that can be counted for graduation.

Not all courses are offered each year. Check with the department for current offerings.

Parenthetical numbers preceded by a * indicate a deal listing.
Department of

Mechanical and Aerospace Engineering

College of Engineering

Head: Professor Frank J. Redd, orbital mechanics, control systems, spacecraft systems
Office in Engineering Laboratory 176, 797-2867
Email: frank@mae.usu.edu

Professors J. Clair Batty, thermodynamics, heat transfer, cryogenics; P. Thomas Blotter, engineering mechanics, design, space structures; Ralph H. Haycock, mechanical and cryogenic systems, automation and control systems; Russell M. Holdredge, heat transfer, fluid mechanics; Alma P. Moser, engineering mechanics, piping systems, CAE/CAD; Warren F. Phillips, CAE/CAD/CAM, heat transfer, solar energy, robotics; Edward W. Vendell, cryogenics, heat transfer, thermal systems design; Professors Emeriti Owen K. Shupe, nuclear, material science; W. Karl Somers, manufacturing; Carl D. Spear, material science, CAM; Adjunct Professors Dell K. Allen, manufacturing; Larry H. Brim, bioengineering, heat transfer; Robert H. McEntire, CAD/CAM, productivity, optimization; David G. Norton, manufacturing; Associate Professors Steven L. Folkman, applied mechanics, structural dynamics, space structures; Thomas H. Fronk, composites, materials, mechanics; R. Rees Fullmer, aerospace controls, robotics, dynamics; Assistant Professors Glenn A. Gebert, aerodynamics, aeronautics, fluid mechanics, heat transfer; Christine E. Hailey, aerodynamics, fluid mechanics

Degrees offered: Master of Engineering (ME), Master of Science (MS), and Doctor of Philosophy (PhD) in Mechanical Engineering

Specializations: Aerospace Engineering, Dynamics and Control, Solid Mechanics, Thermal/Fluid Science

Admission Requirements

In addition to the general admission requirements listed on pages 25-26, the department requires that an applicant have a bachelor's degree in Mechanical Engineering, Aerospace Engineering, or a closely related engineering discipline from an accredited institution. A minimum GPA of 3.0 for MS applicants and 3.3 for PhD applicants is required for the last 90 quarter or 60 semester credits earned. Those students who do not have a BS degree in an appropriate engineering discipline may be admitted with provisional status and required to complete remedial courses.

Applicants are also required to submit evidence of potential graduate-level success through GRE scores in several categories. MS applicants are required to submit scores in the verbal, quantitative, and analytical categories. In addition to these three categories, PhD applicants are required to submit a score in the advanced engineering category.

Students are expected to be well acquainted with either the FORTRAN or C programming language.

Further details concerning admission requirements and prerequisites can be obtained by contacting the head of the MAE department or by referring to the appropriate USU Gopher page.

Specializations

The Department of Mechanical and Aerospace Engineering offers both MS and PhD degrees, with specializations in aerospace engineering, dynamics and control, solid mechanics, and thermal/fluid science.

Aerospace Engineering is concerned with atmospheric and space flight. Included are such disciplines as aerodynamics, aircraft flight dynamics, aircraft design, spacecraft orbital mechanics, spacecraft attitude motion and control, aircraft and spacecraft propulsion systems, space system design, and the space environment. Mechanical Engineering graduates choosing the aerospace option may pursue careers in aircraft and/or spacecraft design and development, rocket and turbine propulsion systems, aircraft flight testing, and space trajectory design and analysis, as well as the broader, traditional mechanical engineering fields.

Dynamics and Control is that branch of Mechanical Engineering concerned with describing and controlling the motion of mechanical systems. Included within its scope are the fundamental studies of dynamics, kinematics, vibrations, control theory, hydraulics and pneumatics, and machine design. Mechanical Engineering graduates who choose the dynamics and control program are prepared to pursue careers in all fields in which force and motion acting on structures and machines occur, including aerospace, automotive, defense, heavy equipment, machine tools, and manufacturing.

Solid Mechanics is concerned with mechanics of materials, stress analysis, material science, properties of materials, and material selection for optimum design. It includes courses that deal with design using traditional metals and modern alloys, and courses on engineering with plastics and high-tech composite materials. Students study how structures constructed of various materials react and deform when subjected to loads. Students learn to use the finite element method as well as classical methods for the determination of stresses, strains, and displacements. Mechanical Engineering graduates who select the solid mechanics program are prepared to pursue careers in private industry, government, education, and engineering consulting. Some industrial areas which require engineers with this type of training are aeronautics, aerospace, automotive, building, electronics, defense, and public utilities.
Thermal/Fluid Science is a branch of Mechanical Engineering that is primarily concerned with energy, including its conservation, its conversion to more useful forms, its transmission to needed locations, and its utilization. Included within its scope are the fundamental studies of thermodynamics, heat transfer, and fluid mechanics. Mechanical Engineering graduates who select the thermal/fluid science program are prepared to pursue careers in such widely diverse disciplines as aeronautics, aerospace, automotive, chemical, electric utilities, electronics, environmental engineering, food processing, heating and air conditioning, nuclear, petroleum, and alternate energy sources.

Degree Requirements

In addition to the general degree requirements listed on pages 26-30, the Mechanical and Aerospace Engineering Department requires the following:

The Plan AM S Degree requires 12 credits of graduate level coursework in Mechanical Engineering fundamentals; 18 credits of 600-level (or above) engineering coursework exclusive of MAE 680, 693, 699, and 699; a minimum of 6 credits of 500-level (or above) coursework in approved mathematics; and 15 credits selected from any one of the four declared areas of specialization listed above. A minimum of 45 credits is required beyond the BS, including a 9-credit thesis (MAE 697). The thesis must meet graduate school requirements. A paper with the student as author or coauthor, submitted for publication in a refereed journal, is also required.

The Plan C MS Degree requires 18 credits of graduate level coursework in Mechanical Engineering fundamentals; 27 credits of 600-level (or above) engineering coursework exclusive of MAE 680, 693, 699, and 699; a minimum of 6 credits of 500-level (or above) coursework in approved mathematics; and either 21 credits selected from any one of the four declared areas of specialization or 15 credits selected from each of two areas. A minimum of 51 credits is required beyond the BS which may not include a thesis (MAE 697) but may include up to 6 credits of Design Project (MAE 695). MAE 695 requires a report written to thesis standards.

The PhD Degree requires 18 credits of graduate level coursework in Mechanical Engineering fundamentals; 36 credits of 600-level (or above) engineering coursework exclusive of MAE 680, 693, 699, 697, 699, 793, 797, and 799; a minimum of 12 credits of 500-level (or above) coursework in approved mathematics; and 24 credits selected from any one of the four declared areas of specialization. A minimum of 135 credits is required beyond the BS including a dissertation (MAE 797). The dissertation must meet graduate school requirements and be at least 36 credits but no more than 45 credits. A paper with the student as author or coauthor, submitted for publication in a refereed journal, is also required.

Before receiving an MS degree, all students are required to take the Advanced Engineering portion of the Graduate Record Exam. A score at or above the 45th percentile is required for graduation with an MS degree and a score at or above the 70th percentile is required for admission to candidacy in the PhD program.

Further details concerning degree requirements and program coursework can be obtained by contacting the head of the department.

Research Opportunities

The Department of Mechanical and Aerospace Engineering is conducting research in all of the areas of specialization listed above. Departmental research projects are funded by both government agencies and private industry. Current research topics include analytical and experimental structural dynamics, buried structures, plastics and composite materials, numerical modeling and design of composite structures, computational and experimental fluid dynamics, aerodynamics, thermodynamics, heat transfer, cryogenics, intelligent control systems, control of unmanned aircraft, spacecraft and satellite control, design and analysis of space systems, orbital mechanics, remote sensing, and robotics.

Financial Assistance

A number of teaching and research assistantships are available to graduate students through the department, and are awarded on a competitive basis each year. In addition, scholarships covering the nonresident portion of tuition are available each quarter, on a competitive basis, to nonresident students who hold a graduate assistantship paying at least $185 per month. Students interested in working part time as teaching or research assistants should make application to the department by March 31 for the coming academic year.

Acceptance to pursue graduate studies in the Department of Mechanical and Aerospace Engineering does not imply a commitment to any type of financial aid. All awards for financial aid are made on a competitive basis after applicants are admitted to graduate school. All students who receive any type of financial support from the University or who are supplied University space for study or research must carry a minimum of nine credits each quarter while receiving such support.

Obtaining More Timely Details

Due to the fact that the MAE graduate program occasionally undergoes fine tuning and updating, prospective students are advised to seek further details from the following sources: MAE Gopher Page for Utah State University; MAE WWW Page for Utah State University; Internet e-mail request: redd@cc.usu.edu.

Mechanical and Aerospace Engineering Courses

501. Finite Element Methods in Solid Mechanics. Introduction to finite element methods and their application to the analysis and design of mechanical engineering systems. Prerequisite: MAE 594 or instructor's consent. (3W)

502. Mechanical Vibrations. Free, damped, and forced linear vibrations of discrete systems. Prerequisite: Engr 203. (3P)

503. Orbital Mechanics. Classical two-body orbital mechanics, orbit determination, basic orbital maneuvers, time of flight, lunar and interplanetary trajectories, and perturbation methods. Prerequisite: Engr 203. (3F)

504. Advanced Mechanics of Materials. Continuum mechanics applied to airplane and spacecraft structures. Includes topics on strength of materials, thin-walled structures, and energy methods with associated structural analysis techniques. Prerequisites: Math 320, CEE 305. (3F)

508. Mechanics of Composite Materials. Stress-strain relations for nonisotropic composites, such as fiber-reinforced plastic laminates, proper-
ties and their use, strength and life determination, and methods for design using composite materials. Prerequisite: CEE 305. (3F)

**509. Spacecraft Attitude Dynamics.** Focus will include dynamics of a system of particles; angular momentum and moments; rigid body motion; gyroscopic instruments; spacecraft attitude motion; and spacecraft attitude control. Prerequisites: MAE 424 and 605. (3Sp)

**513. Principles of Numerical Control.** Product design analysis for N/C application. Selection, justification, application, and implementation of N/C equipment. Operational planning, manual, and computer-aided programming for N/C. Prerequisites: MAE 211, 276. (3F)

**514. Material Science.** Emphasis on mechanics, behavior, and chemistry of polymer. Topics include polymer properties, selection criteria, manufacturing methods, and design methods, including viscoelastic behavior, wear characteristics, and nonlinear stress-strain relations. Prerequisite: MAE 415 or instructor's consent. (3Sp)

*521. Computer-aided Manufacturing.** Computer fundamentals, interface electronics, and microprocessor utilization pertaining to manufacturing engineering. Prerequisites: MAE 211, 424, ECE 270, 271. (3W)

*522. Integrated Manufacturing Systems.** Computer applications in the integration of computer-aided design, computer aided manufacturing, and manufacturing resource planning. The nonprocess control aspects of CAM will be emphasized. Prerequisite: MAE 211. (3Sp)

*523. Robotics.** Overview of robotics as a manufacturing technology, applications, geometrics and kinematics of five and six axis robots, tooling and assembly operations, programming and control. Prerequisite: Engr 203. (3F)

525. Hydraulics and Pneumatics. Fluid power and controls as applied to machine tools. Prerequisite: MAE 355. (3Sp)

527. Quality Control. Quality control techniques and systems for industry. Prerequisite: MAE 211. (3Sp)

531. Thermal Systems Design. Cycles, chemical reactions, introduction to design optimization, design projects. Prerequisites: MAE 331 and 336. (3F)

532. Thermal Environmental Design. Air conditioning and heating, solar utilization, thermal environmental control, laboratory exercises, design project. Prerequisites: MAE 331, 355. Must be taken concurrently with MAE 336. (3Sp)

540. Aerodynamics. Dynamics of an incompressible, inviscid flow field; characteristic airfoil parameters; incompressible flow around two-dimensional airfoils and finite wings; supersonic aerodynamics. Prerequisite: MAE 355. (3W)

**541. Dynamics of Flight in the Atmosphere.** Scope includes the development of equations of motion for flying vehicles; aerodynamic forces and moments; longitudinal, lateral, and roll motion; stability; and qualitative flight analysis. Prerequisite: MAE 540. (3Sp)

554. Gas Dynamics. Application of conservation of mass, momentum, and energy to the design and analysis of compressible fluid systems. Prerequisites: MAE 331, 355. (3F)

**575. Dynamic System Modeling.** Introduces modeling of dynamic systems for on-line control of processes using autoregressive and autoregressive moving average models. Prerequisite: MAE 424. (3Sp)

**576. Production Tool Design.** Design of special tooling, jigs, and fixtures for economical production. Emphasis placed on pre-design analysis, cutting force analysis, locating, positioning, and clamping requirements. Prerequisites: MAE 276, CEE 305. (3W)

585. Space Systems Design I. Introduction to space mission and vehicle design. Prepares students for the formal space system design activities that follow in MAE 586 and 587. Multidisciplinary. Prerequisite: Junior level or above in Science or Engineering. (1F)

586. Space Systems Design II. Multidisciplinary systems design course focused upon the detailed design of a spacecraft. Prerequisite: MAE 585 or instructor's permission. Must commit to MAE 587. (3W)

587. Space Systems Design III. Multidisciplinary space systems design course. Completes the design activity in MAE 586. Culminates in a formal Critical Design Review. Prerequisite: MAE 586. (2Sp)

590. Cooperative Practice. A planned work experience in industry. Detailed program must have prior approval. Written report required. Student must be in professional program. (3F)

591. Cooperative Practice. A planned work experience in industry. Detailed program must have prior approval. Written report required. Student must be in professional program. (3F)

**600. Advanced Dynamics.** Dynamic modeling of mechanically complex systems with multiple degrees of freedom. Approach includes advanced Newtonian, Lagrangian, and Hamiltonian methods. Prerequisite: Engr 203. (3F)

**602. Mechanical Vibrations.** Advanced principles of dynamics and vibrations. Matrix methods, Lagrange's equations, variational techniques, etc. Emphasis on continuous systems such as beams and plates. Prerequisite: MAE 502 or instructor's consent. (3F)

604. Continuum Mechanics. Mechanics of a continuous medium. Tensors, stress, strain, deformation, rate of deformation, and constitutive equations as related to solids, fluids, and gases. Prerequisite: CIE 505 or instructor's consent. (3F)

605. Elastic Theory. Field equations, plane strain, plane stress, biharmonic solutions, energy theorems, variational techniques. Saint-Venant torsion and bending theory as applied to linear elastic material. Prerequisite: MAE 604 or instructor's consent. (3W)

606. Plasticity Theory. Analysis of stresses, deformation, and collapse in devices constructed of plastic material. Prerequisite: MAE 604 or instructor's consent. (3Sp)

**607. Advanced Astrodynamics.** Advanced topics in astrodynamics to include: general and special perturbations, nonspherical earth effect, Lagrange's equations, the Restricted Three-Body problem, and Lambert's Theorem. Prerequisite: MAE 503. (3Sp)

**608. Advanced Mechanics of Composite Materials.** Composite materials, and design methods, including viscoelastic behavior, wear characteristics, and nonlinear stress-strain relations. Prerequisite: MAE 585. (3W)

621. Manufacturing Simulation and Optimization. Computer simulation of manufacturing, integration of computerization processes, and production for optimal factory operation. Prerequisite: MAE 521. (3Sp)

623. Robotics. Advanced robotics, coordinate transformation using matrix algebra, sensing, feedback control, computer control of multiple robot systems, and high-level interactive control language. Prerequisite: MAE 523. (3W)

**630. Thermodynamics.** Applications include statistical thermodynamics, distribution functions, molecular wave function, electron and photon gas modeling, properties of solids, and chemical equilibrium. Prerequisites: MAE 331 or instructor's consent. (3F)

655. Transport Phenomena. Systematic and parallel treatment of momentum transfer (viscous flow), heat transfer, and mass transfer. Prerequisite: MAE 330. (3W)

**656. Convective Heat and Mass Transfer.** Prerequisite: MAE 336. (3F)

**657. Conductive Heat Transfer.** Prerequisite: MAE 336. (3Sp)

658. Radiation Heat Transfer. Prerequisite: MAE 336. (3Sp)

643. Aeroelasticity. Unsteady aerodynamics and the coupling between aircraft structural elasticity with steady and unsteady aerodynamic force functions. Prerequisite: MAE 540. (3F)

**653. Viscous Fluid Flow.** Motion of fluids when viscous effects are important. Analysis of boundary layers, shear layers, low Reynolds number flows, and hydrodynamic stability. Prerequisite: MAE 540 or CEE 657. (3Sp)

**655. Space Rocket Propulsion.** Fundamentals of rocket propulsion to include nozzle theory and thermodynamic relations; combustion processes; flight performance; solid, liquid, and hybrid rocket engines; and advanced engine concepts. Prerequisite: MAE 554. (3W)

656. Aircraft Propulsion Systems. Primary emphasis on turbine engine propulsion systems to include turbojets, turboprops, afterburners, and advanced unducted fan concepts. Prerequisite: MAE 554. (3W)

**657. Potential Fluid Flow.** Application of the principles and methods of classical hydrodynamics to the solution of problems. Prerequisites: CEE 351 or MAE 355. (3W)

**658. Computational Fluid Dynamics.** Methods used to numerically solve equations governing the flow of fluids as they interact with aerospace structures. Prerequisite: MAE 540, 554, or instructor's permission. (3F)

672. Finite Element Methods in Solid Mechanics II. Advanced theory and applications of finite element methods to both static and dynamic solid mechanics problems. Prerequisite: MAE 501. (3Sp)
Department of

Music

College of Humanities, Arts and Social Sciences

Head: Associate Professor Bruce M. Saperston, music therapy
Office in Chase Fine Arts Center 107, 737-3000

Professors Gary Amano, piano; Michael L. Ballam, voice; Warren L. Burton, cello, bass; Michael K. Christiansen, guitar; Willard R. Kesling, voice; F. Dean Madsen, theory, composition; Larry G. Smith, jazz; Professors Emeritus Max F. Dalby, director emeritus of bands; Glen A. Fifield, trumpet; Alvin Wardle, brass; Irving Wasserman, piano;

Associate Professors James M. Drake, organ; Mark A. Emile, violin; Dennis D. Griffin, percussion, Associate Professor Emeritus Mildred Jane Johnson, music history; Assistant Professors Betty Beecher, group piano; Todd L. Fallis, music education, low brass; Thomas K. Foster, piano; Nicholas E. Morrison, clarinet, woodwind; Marlin Volovna, voice; Faculty Assistants Lisa Almond, music therapy; Karen Carter, music therapy; Derek Furch, jazz choir; Bonnie Slade, women’s chorus, voice; Leslie Timmons, flute; Applied Music Staff Betty Hammond, voice; Chiyô Honma, piano; Carolyn Jones, bassoon; J’Lene Mendenhall, voice; Debbie Monday, string bass; Michael Packham, horn; Susan Swidnicki, oboe

Degree offered: Master of Education (MEd) in Secondary Education with specialization in Music

Admission Requirements

See general admission requirements (pages 25-26). Each candidate for the MEd with emphasis in Music must successfully complete an examination for admission to the program. This examination may be taken under the supervision of a proctor at a college or school near the candidate’s place of residence and approved by the department.

Degree Requirements

Students may elect a thesis project, a lecture-recital or concert-recital, or a nonthesis study. All work is to be completed under the supervision of a graduate committee.

Required courses for the MEd are Music 450, 600, 680, and 688. Other requirements include (1) the Department of Secondary Education core, 12 credits; (2) the departmental core, 22 credits; and (3) supporting coursework, 20 credits chosen from music courses listed above and additional class work selected from Music 507, 508, 509, 518, 605, 686, 687, and 697.

Music Courses


503. Music Therapy Practicum. Practicum experience continued in working with children with disabilities. Individual and group work stressed. (1Sp)

504. Music Therapy Practicum. Practicum experience in working with adults/aged with disabilities. Individual and group work stressed. (1W)

507. Scoring and Arranging. Theoretical and practical study of scoring for wind, string, and percussion instruments in various combinations ranging from small ensembles to the symphonic band and symphony orchestra. (3W)

508, 509. Counterpoint. Writing and analysis of modal and tonal counterpoint in two, three, and four parts. Prerequisites: Music 104, 105, 106, 304, 305, 308. (2F) (2W)
515, 516, 517. Advanced Piano Pedagogy. Continuation of pedagogy 315-317 with analysis, performance, and teaching of basic repertoire at the intermediate to advanced levels. (1-2F) (1-2W) (1-2Sp)®

518. Composition and Analysis. Analysis of twentieth century masterworks; instruction in principles of music composition and guidance in completing individual composition projects. Prerequisites: Music 104, 105, 106, 301, 302, 303. (3F, W, Sp)®

522. Techniques in Electronic Music. Designed as a continuation of Synthesizer Fundamentals 222. Students will learn to operate large studio synthesizer and associated audio equipment. Prerequisite: Music 222. (2-5Sp)®

600 (500). Introduction to Music Research. Systematic and historical fields of musical knowledge and research. Introduction of research methodologies in music. (3)

605. Independent Study. An advanced course designed to meet specific problems of the music educator and the applied music specialist. (1-3F, W, Sp, Su)

608. Graduate Performance Ensemble. Course is designed to give students opportunity for high level chamber music experience on his/her major instrument. (1-2)

610. Advanced Conducting. Purpose of course is to master the technical elements of the baton and improve score study procedures, resulting in the analyzing and communicating of musical ideas. (5)

615. Advanced Rehearsal Techniques. Purpose of course is to provide students experience within their major performance areas, i.e., choral, band, orchestra. This will be accomplished through observation of procedures and rehearsal techniques, and by conducting sectional and full rehearsals under the direction of the major professor. (3F, W, Sp, Su)

621. Practicum in Choral Performance. Provides the graduate student with insight into advanced choral techniques and methods of teaching and preparing choirs for performance by rehearsing one of the University choirs on assigned choral selections while being coached/critiqued by the instructor. (1-5)

633. Seminar in Choral Literature. Designed to study and internalize a connected account embracing the historical evolution and stylistic characteristics of the principal forms of choral music. Will embrace great literature of the periods. (3)


682. Seminar in Music Theory. (3)

686. Graduate Private Instruction. (1-2)

687. Individual Recital. Preparation and presentation of a graduate recital. Supervision of the major professor. (3-5F, W, Sp, Su)®

688. Descriptive and Experimental Research in Music. Emphasis upon (a) structuring research designs, (b) execution of an experimental project, (c) preparation of the research report. (3Sp)


699. Continuing Graduate Advisement. (1-3)®

® Repeatable for credit. Check with major department for limitations on number of credits that can be counted for graduation.

Parenthetical numbers preceded by an f are the former course numbers.

Music emphasis courses for the Master of Education degree.

Department of Nutrition and Food Sciences

College of Agriculture and College of Family Life

Head: Professor Ann W. Sorenson, nutrition
Office in Nutrition and Food Sciences 212, 797-2126

Professors Rodney J. Brown, food and dairy chemistry; Conly L. Hansen, food engineering; Deloy G. Hendricks, nutrition, food storage; Von T. Mendenhall, meat technology, food science; Bonita W. Wyse, dietetics, nutrition education; Distinguished Professor Emeritus D. Gaurth Hansen, human nutrition; Professors Emeritus C. A. Ernstrom, cheese technology; Gary H. Richardson, food microbiology, instrumentation; D. K. Salunkhe, food processing; Associate Professors Charlotte P. Brennand, flavor and sensory evaluation; Charles E. Carpenter, muscle biochemistry and physiology, meat processing; Daren P. Cornforth, meat and muscle chemistry; Georgica C. Lauritzen, nutrition, dietetics; Donald J. McMahon, dairy chemistry and technology; Ronald G. Munger, nutrition, epidemiology; Paul A. Savello, dairy processing; Carol T. Windham, nutrition monitoring, dietary guidance; Assistant Professors Jeffery R. Broadbent, microbial genetics; Joseph Irudayaraj, bioprocessing and food engineering; Ilka Nemere, molecular nutrition; Marie K. Walsh, dairy chemistry; Bart C. Weimer, dairy microbiology; Clinical Assistant Professors Janet B. Anderson, dietetics; Nedra K. Christensen, dietetics; Norreen B. Schwanevedt, dietetics

Degrees offered: Master of Arts (MA), Master of Science (MS), Doctor of Philosophy (PhD) in Nutrition and Food Sciences

Specializations: Dietetics, Food Biotechnology, Food Chemistry, Food Engineering, Food Microbiology, Food Processing, Human Nutrition, Molecular Biology, Nutrient Metabolism

Special Admission Requirements

Candidates for graduate study in the Department of Nutrition and Food Sciences need a background in chemistry, physics, mathematics, bacteriology, and physiology. Prior coursework in food science or nutrition is desirable. If deficient in these areas, a student may be accepted with the understanding that their supervisory committee will require competence equivalent to a BS degree in nutrition and food sciences in the preliminary (MS) or comprehensive (PhD) examination.

Students must meet the following departmental requirements in addition to requirements of the School of

130 Nutrition and Food Sciences
Graduate Studies. A more detailed outline of these requirements is available from the department.

1. Graduate Record Examination scores at the 40th percentile or higher on the Verbal section, the Quantitative section, and the Analytical section, and a combined score of at least 1,500 on the verbal, quantitative, and analytical sections are required for admission.

2. One year of general chemistry, two quarters of organic chemistry, and math at least equivalent to college algebra must be completed before matriculation. If taken as a graduate student, these courses will not be counted for graduate credit.

3. Before being accepted to work toward a PhD degree, a student must have obtained an MS degree, or have a manuscript reporting original research accepted for publication in a refereed journal.

4. Before being accepted into the department, potential graduate students must be accepted by a faculty member who is willing to add them to his or her research team.

Registration Requirements

Once admitted, students are required to maintain enrollment as follows:

1. At least 3 credit hours must be taken each quarter in order for the student to use University facilities and receive direction from his or her major professor.

2. If on a graduate teaching or research assistantship, the student must take at least six credit hours per quarter. Students on a research fellowship must take at least six credit hours per quarter.

3. Students receiving tuition waivers, student loans, or other University-administered financial aid must take at least six credit hours per quarter.

4. If employed full time by the University, a student may take no more than 6 credit hours per quarter.

Graduation Requirements

The steps for progressing toward an advanced degree are outlined here. The student is responsible to see that all requirements are fulfilled.

1. Choose major professor. Students are accepted into the department with a temporary adviser. However, they may choose as their major professor any faculty member who can and is willing to accommodate them.

2. Establish supervisory committee. In consultation with the major professor, the student should consider faculty members to serve on his or her supervisory committee. For the MS program, a minimum of three members must be suggested, with at least two from the department and including the major professor for the MS program. PhD candidates must suggest a minimum of five members, with at least three from the department and at least one from outside the department.

After the student and major professor have agreed on the committee members, a Supervisory Committee Assignment form must be prepared. The department head must approve the committee and may add members. It is the student's responsibility to contact proposed committee members to make certain they are able and willing to serve. The Committee Assignment Form is then forwarded to the Dean of the School of Graduate Studies for final approval. The committee should be selected and the Committee Assignment Form submitted to the School of Graduate Studies no later than the second quarter of an MS program and no later than the third quarter of a PhD program.

3. Select and define research program. In consultation with the major professor, the student must choose a research area suitable for the MS thesis or PhD dissertation, and then prepare a thesis or dissertation proposal. The proposal should include the following: (1) title; (2) description of the problem based on the most current literature; (3) statement of the purpose of the intended research; (4) research plan; and (5) list of the references cited in a form that is acceptable for publication in a scientific journal in the student's field.

4. Define course schedule. Students must decide, with their major professor, which courses they will take. They must fulfill the minimum requirements for all graduate students in Nutrition and Food Sciences, as listed below, as well as take other courses to provide the background necessary to conduct their research.

The minimum course requirements for all graduate students in the Department of Nutrition and Food Sciences are as follows. Required credits for the PhD include MS credits. (See pages 30-33 in this catalog for School of Graduate Studies requirements.) Additional courses will be required by the supervisory committee.

Biochemistry (Chem 670, 671, 672, 676). 3 credits required for MS; 12 credits required for PhD.

Statistics (Stat 602, 503, 510, 515, 520, 542, 560, 605). 6 credits required for MS; 12 credits required for PhD.

Graduate level NFS courses. 8 credits required for MS; 14 credits required for PhD. PhD students must include one class from NFS 630, 631, 643; and one class from NFS 510, 603, 606.

Additional graduate level courses (from NFS or elsewhere). 3 credits required for MS; 15 credits required for PhD.

Graduate seminars (NFS 780). 2 credits required for MS; 4 credits required for PhD.

Graduate seminars in other departments. 1 credit required for MS; 2 credits required for PhD.

Teaching experience (NFS 690). 0 credits required for MS; 3 credits required for PhD.

Research (NFS 697, 797). 9-20 credits required for MS; approximately 45 credits required for PhD. Research credit will be assigned at the discretion of the major professor.

Total credits required. At least 45 credits are required for the MS; at least 135 credits are required for the PhD.

5. Meet with supervisory committee. Prior to the first meeting of the supervisory committee, the student must complete the Application for Candidacy for Master's Degree or Program of Study (for the PhD) forms. A copy of the form and the research proposal should be given to each committee member several days before the meeting.
The purpose of this meeting is to: (1) secure the committee's approval of the program of study—deficiencies in academic background will be discussed and plans made to resolve them; (2) obtain the committee's approval of the research plan; (3) discuss aspects of the research; (4) allow the committee to determine the topic areas the student must pass in the NFS graduate examinations.

All members of the committee and the department head must sign the form before it is sent to the School of Graduate Studies.

6. Commence research and continue courses. Students should take the approved courses and conduct the research as outlined in the approved research proposal.

7. Take written NFS graduate examinations. NFS graduate examinations are held each quarter with three NFS topics offered each time. MS students must pass two examinations as designated by the committee. PhD students must pass four examinations, three of which are designated by the committee. Students may sit for these examinations throughout their program, but no examination topic may be attempted more than three times.

8. Take preliminary (MS) or comprehensive (PhD) examination. The examination is taken after passing the required NFS graduate examinations. It is an examination of general knowledge that the student should have at this stage of academic training. Material to be included is determined by the committee, but emphasis is on knowledge applicable to the research.

9. Complete Application for Candidacy forms. PhD candidates must submit the Application for Candidacy form to the School of Graduate Studies. It must be signed by all members of the committee at the end of the comprehensive examination and by the department head. This form must be received by the School of Graduate Studies at least three months before the dissertation defense.

The chairperson of the committee must certify on the Application for Candidacy for Master's Degree form for MS students that the preliminary examination has been passed. The form, with this final signature, must be sent to the School of Graduate Studies.

10. Complete research and write thesis or dissertation.

11. Departmental seminar. The student must present a regularly scheduled seminar in the department to report the results of his or her research. This must be done before the defense of the thesis or dissertation.

12. Submit manuscripts. Manuscripts reporting the student's research results must be submitted to refereed journals for publication before defense of the thesis or dissertation.

13. Final examination (thesis or dissertation defense). When both the student and the major professor are satisfied that the thesis or dissertation is editorially correct, copies are given to the members of the committee. This should be done several weeks before the examination. The final examination is scheduled with the School of Graduate Studies. The appointment form is to be signed by each committee member, verifying that they have read the thesis or dissertation and it is ready to be defended at the scheduled day and time.

14. Submit thesis or dissertation. After all changes suggested during the defense have been made, the thesis or dissertation is submitted to the departmental thesis reviewer. The thesis or dissertation is submitted to the School of Graduate Studies for approval only after all corrections suggested by the departmental reviewer have been made.

Financial Assistance

Some teaching assistantships and research fellowships and many research assistantships are available to graduate students in the Department of Nutrition and Food Sciences. Teaching assistantships are used to cover the teaching needs of the department. Research fellowships and research assistantships are available through individual faculty members. Most research assistantships are tied to specific research projects.

Career Opportunities

There is a continuing shortage of MS and PhD graduates in nutrition and food sciences. Many MS graduates go on to obtain a PhD, but all graduates have a wide choice of career opportunities.

Nutrition and Food Sciences Courses

516. Methods in Biotechnology: Cell Culture. Laboratory-intensive course in basic and applied methods of culturing cells (mammalian, insect, plant) and methods of fusing and transforming cells. Prerequisites: Biol 125 or ADVS 316 or equivalent, or permission of instructor. (3W)

524. Methods in Biotechnology: Protein Purification Techniques. Laboratory-oriented course designed to provide basic knowledge in protein purification, analysis, and its scale up. Prerequisites: Chem 370 or ADVS 316, or permission of instructor. (3Sp)


526. Methods in Biotechnology: Molecular Cloning. Laboratory-oriented course in molecular cloning techniques such as DNA cloning, genetic probing, PCR, DNA sequencing. Prerequisites: Chem 370 or Biol 319 and Micro 301 or equivalent, ADVS 316, or permission of instructor. (3F)

540. Human Nutrition—An Integrated Approach. An Independent Study Division course. (3)


693 (d503). Dairy Processing. Processing milk into cheese, ice cream, yogurt, concentrated milks, and spray-dried powders. Identity standards of regulated dairy products. Physical, chemical, and biochemical changes that occur during manufacture and storage. Bacteriological, chemical, and physical deterioration and control. Four lectures, one lab. (5F)

695. Advanced Clinical Nutrition. Study of selected topics in clinical nutrition, including reports on current advances and presentation of nutrition support topics (case studies) developed through research. Prerequisite: RD or instructor's permission. (2W)

696. Principles of Food Processing. Standardization and compounding food products; food preservation through application of heat, re-
frigation, concentration, and dehydration. Basic unit operations in the food industry. Quality control of raw and finished products. Four lectures, one lab. Prerequisite: NFS 644/544. (5Sp)


611 (d511). Food Microbiology. Microorganisms in food production, preservation, spoilage, poisoning, and sanitation. Prerequisite: Micro 111 and 112, or Micro 301. Three lectures and two labs. (5W)

613 (d513). Food Fermentations. The microbiology and biochemistry of food fermentations. Prerequisite: NFS 611/511. Three lectures and one lab. (4Sp)

615 (d515). Microbiology of Dairy Foods. Information about the microorganisms associated with raw and processed milk. New microbial identification techniques used for lactic acid bacteria will also be discussed. Prerequisite: Micro 301. (4F)


*621. Advanced Public Health Nutrition and Public Policy. The scientific basis for public health recommendations regarding nutrition and human health will be reviewed with an emphasis on epidemiology methods and population-based studies. Prerequisite: NFS 620. (3Sp)

630 (d530). Human Nutrition—Vitamins, Minerals, and World Food Supply. An overview of world food production and consumption trends as they relate to nutritional status of individuals. Metabolism of vitamins and minerals as applied to nutritional requirements and food supplies of people. Prerequisites: NFS 440, Chem 370. (4Sp)


*643 (d543). Developmental Nutrition. Role of nutrition in embryonic and postnatal development including effect of maternal nutritional status in pregnancy and lactation; neonatal needs; and current infant feeding practices. (3F)

644 (d544). Food Engineering. Introductory concepts in fluid mechanics and heat transfer. Engineering measurement techniques presented in the laboratory. Prerequisite: NFS 444. (3W)

*645. Meat Science. Structure of muscle tissue, chemistry of contraction and relaxation, factors affecting meat tenderness, postmortem changes and their effect on meat quality. Prerequisites: Chem 370, NFS 345. (4W,Sp)


651 (d551). Food Laws and Regulations. Provides background of federal/state laws and regulations and case law history affecting food production, processing, packaging, marketing, and distribution of food products. (3W)

656 (d556). Chemistry of Food Constituents. Chemical structure, properties, and reactions of the important chemical constituents of food. Three lectures, one lab. Prerequisites: Chem 331, 332, 570, NFS 407. (4W)

657 (d557). Chemistry of Food Systems. Chemical relationship among constituents in liquid and tissue food systems. Their reactions and interactions during food processing. Three lectures, one lab. Prerequisite: NFS 656/556. (4W)

*660. Food Proteins and Enzymes. Structure and functions of proteins and enzymes in foods, uses of enzymes in food processing. Prerequisite: Chem 370 or 670. Three lectures, one lab. (4W)

663. Nutrition in Aging. Theories of aging and nutrition as affected by physiologic and metabolic changes. Nutritional requirements and assessment of elderly implications for nutrition programs, policies, research, and education. Prerequisites: Chem 370, Phys 130, NFS 222. (3Sp)

**670. Dairy Chemistry. Chemical and physical properties of milk components and their interactions in various dairy products. Prerequisites: NFS 656/556, Chem 370 or 670. (3W)

675 (d575). Dietetics Clinical Practicum. Advanced practical experience in dietetics within community and/or health care facilities. Prerequisite: NFS 466 or RD. (1-10W,Sp)

676 (d576). Dietetics Management Practicum. Advanced practical experience in food service management for dietetics. Prerequisite: NFS 472 or RD. (1-10W,Sp)

690. Special Problems. (1-4F,W,Sp,Su)®

697. Thesis Research. For students working on MS research. (1-12F,W,Sp,Su)®

699. Continuing Graduate Advisement. (1-12F,W,Sp,Su)®

**714. Biotechnology of Lactic Starter Cultures. Examination of genetics and microbiology of lactic starter cultures, with emphasis upon unique characteristics these microorganisms possess. Development and application of biotechnology, including recombinant DNA techniques, presented as applied toward strain improvement and design. Prerequisite: NFS 615/515. (4Sp)

780. Seminar. Reports and discussion on research and current literature. (1F,W,Sp)®

797. Dissertation Research. For students working on PhD research. (1-12F,W,Sp,Su)®

799. Continuing Graduate Advisement. (1-12F,W,Sp,Su)®

*Taught 1995-96.
**Taught 1996-97.
® Repeatable for credit. Check with major department for limitations on number of credits that can be counted for graduation.

1Parenthetical numbers preceded by d indicate a dual listing.
Department of
Physics
College of Science

Head: Professor W. John Raitt, space plasma physics
Office in Science Engineering Research 250A, 797-2857

Professors Kay D. Baker, atmospheric and space physics; W. Farrell Edwards, electrical and fundamental interactions; Bela G. Fejer, upper atmospheric physics; Wilford N. Hansen, reflection spectroscopy, surface and fundamental physics; Don L. Lind, space physics; V. Gordon Lind, medium energy nuclear physics; William R. Pendleton, atomic and molecular processes; Robert W. Schunk, space plasma physics; Jan J. Sofka, atmospheric and space physics; Vincent B. Wickwar, atmospheric and space physics; Research Professors Frank T. Berkey, atmospheric and space physics; Patrick J. Esay, atmospheric and space sciences; Kent L. Miller, upper atmospheric physics; Professors Emeritus Jack E. Chatelain, classical and quantum field theory; Eastman N. Hatch, nuclear physics; L. Rex Megill, atmospheric and space physics; John K. Wood, spectroscopy; Adjunct Professors Ajit Banerjee, theoretical physics; Stephen E. Bialkowski, physical chemistry; Yeaton H. Clifton, mathematical physics; John W. Meriwether, Jr., space physics; R. Gilbert Moore, space physics; Linda S. Powers, biophysics; Paul L. Reeder, nuclear physics; Robert G. Roper, upper atmospheric physics; Wolfgang Schmickler, surface physics; Thomas D. Wilkerson, atmospheric and space physics; William W. Wright, ionospheric physics; Associate Professors J. R. Dennison, surface physics; James T. Wheeler, mathematical physics and general relativity; Research Associate Professors Abdallah R. Barakat, space plasma physics; Howard G. Demars, space physics; J. Steven Hansen, space physics; Ching Yan Pan, condensed matter physics; Michael J. Taylor, atmospheric and space sciences; Adjunct Associate Professors I. Davis, condensed matter; Donald R. Pettit, space science; David J. Vieira, nuclear physics; Associate Professors Emeritus Robert E. McAdams, medium-energy nuclear physics; Akeley Miller, mathematical physics; Assistant Professors Jill A. Marshall, physics education; D. Mark Riffle, surface physics; Charles G. Torre, mathematical physics and general relativity; Adjunct Assistant Professor Charles E. Tinney, technology; Research Assistant Professors David J. Crain, space physics; Lie Zhu, space physics

Degrees offered: Master of Science (MS), Doctor of Philosophy (PhD)

Specializations: Atomic Physics, Electromagnetic Theory, Medium Energy Nuclear Physics, Space Science, Surface Physics, Theoretical Physics, Upper Atmospheric Physics (MS)

Admission Requirements

All students applying for admission to graduate school who plan to work toward a PhD in physics or an MS in physics (except for those applying to work toward the MS—Upper Atmospheric Physics Option) must take the Advanced Physics portion of the Graduate Record Examination (GRE), in addition to the general GRE tests, and have the results forwarded to Utah State University. Students whose native language is not English may also take the TOEFL test.

Students seeking admission to the graduate program must qualify to become fully matriculated to work toward the MS or PhD degree in physics. Matriculation is determined by the student's undergraduate record, letters of recommendation at entrance, performance in graduate courses, performance in research (for those admitted), and score on the Advanced Physics portion of the Graduate Record Examination. If the Advanced Physics GRE score presented for admission to graduate school is sufficiently high for entrance but not for qualification, then the student's score must be improved. Two additional attempts at qualifying are permitted. The first must be no later than immediately after the third quarter since entry into the graduate program, and the second no later than immediately after the fifth quarter after entry into the graduate program. In either case, summer quarters are not counted, and also early qualification can be arranged. The determination of qualification level is made by the faculty, based on evaluation of graduate coursework, GRE physics subject test scores, undergraduate coursework, and other relevant material. The required level for the PhD degree will be higher than that for the MS degree. These qualification requirements do not apply to students in the MS—Upper Atmospheric Physics Specialization.

Students whose native language is not English will be required to take a test given by the Intensive English Language Institute (IELI) at USU. The purpose of the test is to guide the selection of remedial language courses, if needed, to help with physics coursework comprehension.

Course Requirements

Master of Science. In addition to the above general requirements, MS students must complete graduate-level courses in at least two of the following subjects: classical mechanics, Physx 641, 642, and 643; quantum mechanics, Physx 671, 672, and 673; and electricity and magnetism, Physx 661, 662, and 663. The student will also submit and orally defend either a thesis (Plan A) or a research report (Plan B) at the discretion of the student's supervisory committee. Plan A and Plan B MS candidates must present a colloquium to the department on the research topic during the time the thesis or research report is being written. The department also accepts Plan C, which has no research component. The student must complete 51 credit hours of graduate-level coursework, the composition of which shall include the required courses for the non-option MS plan. In addition, the student must present a seminar and a paper to his or her supervisory committee.
on a topic related to educational or managerial aspects of physics graduate education chosen by his or her supervisory committee.

**Master of Science (Upper Atmospheric Physics Specialization).** The department offers an option in Upper Atmospheric Physics for MS students. This option is offered in conjunction with the Department of Plants, Soils, and Biometeorology. A minimum of 24 credit hours of coursework must be selected from the following courses: Phys 461, 462, 463, Electricity and Magnetism; Phys 601, Introduction to Solar Terrestrial Physics; Phys 602, 603, Upper Atmospheric Physics; Phys 704, Ionosonde Physics (prerequisites: Phys 601, 602, 603); Chem 705, Atmospheric Chemistry and Photochemistry (prerequisites: Phys 601, 602, 603); Phys 706, Circulation of the High Atmosphere (prerequisites: Phys 601, 602, 603); Phys 631, 732, Space Science and Engineering; Phys 661, 662, 663, Electricity and Magnetism; Phys 657, 658, 659, Applied Plasma Dynamics; Phys 782, Seminar (Radar Systems); up to 6 credits of Mathematics courses above 300 level; up to 6 credits from the Department of Plants, Soils, and Biometeorology (Bimet 653 and 655 preferred). The student may gain from 9-21 credit hours by research to be written up as a thesis, which must be defended orally. In addition, the student must present a colloquium on the topic of his or her research.

**Doctor of Philosophy.** In addition to the general requirements, the PhD student is required to take two quarters of two course groups and three quarters of the other two course groups selected from the following four groups: Phys 534, 535, 536, Methods of Theoretical Physics; Phys 641, 642, 643, Theoretical Mechanics; Phys 661, 662, 663, Theoretical Electricity and Magnetism; and Phys 671, 672, 673, Quantum Mechanics. These courses must be taken during the first two years of PhD candidacy. The student must also take a written and oral graduate comprehensive examination set by the department. The examination includes graduate-level questions in three subjects: classical mechanics, Phys 641, 642, and 643; quantum mechanics, Phys 671, 672, and 673; and electricity and magnetism, Phys 661, 662, and 663. The questions will cover topics covered in the first two quarters of each of the three subjects. The graduate comprehensive examination is normally taken at the beginning of the third year of graduate study.

The student must also complete a research dissertation and give an oral defense of the dissertation. Furthermore, the PhD candidate is expected to give two colloquium to the department. The first of these will normally be given at the time of submission of the research proposal, the other at the time the dissertation is completed.

**Research**

**Space Science.** The Physics Department is active in the field of atmospheric and space science through research conducted under the auspices of the interdisciplinary Center for Atmospheric and Space Sciences and through a course program in physics and related fields. Atmospheric and space science strongly involves, in addition to physics, such other areas as engineering, chemistry, and meteorology. At USU, these departments enjoy a strong cooperative relationship and, as a result, the atmospheric and space science program has flourished. Students are relatively free to arrange a course program from the offerings of the associated departments suited for their particular interests and needs while they gain research experience on challenging problems in atmospheric and space science. Opportunities are available for students in both experimental and theoretical projects. These include participation in instrumentation development and data analysis related to balloon, rocket, satellite, and space shuttle projects and projects in experimental design and data analysis related to incoherent-scatter and coherent radars and ground-based optical instruments. Opportunities also exist in theoretical modeling of physical processes occurring in both the neutral atmosphere and in the plasma in the solar-terrestrial environment.

**Atomic and Molecular Physics.** Atomic and molecular processes which contribute to the infrared emissions associated with the terrestrial airglow and aurorae are currently being studied by means of FTIR spectroscopic methods. In selected cases, pertinent complementary laboratory investigations of excitation (electron and/or heavy particle impact) and deexcitation (radiative and collisional) processes have been conducted.

**Electromagnetic Theory.** The study of perfect conductors in the presence of magnetic fields has interesting applications to space plasmas, and illuminates certain properties of quantum fluids such as superconductors. Using minimum-energy principles, researchers attempt to model magnetic structures such as flux ropes near Venus, filaments in the solar corona, and fluxoids in superconductors.

**Surface Physics.** Surfaces and interfaces are investigated experimentally. The dynamics and bonding of adsorbed molecules and surface electrons are studied using optics, ultrafast femtosecond spectroscopy, reflection spectroscopy, IR spectroscopy, surface potential measurements, and inelastic neutron scattering. In particular, molecules adsorbed on metals or semiconductors are observed spectroscopically. The structure and phase transitions of adsorbed layers are investigated with LEED, Auger spectroscopy, and x-ray and neutron diffraction. This interdisciplinary research brings together the fields of solid state physics, surface physics and chemistry, optics, physical chemistry, and electrochemistry. It includes both basic research and applications. This program is open both to physics and chemistry majors.

**Theoretical Physics.** The department maintains an active research program in theoretical physics, with emphasis on gravitational theory and quantum field theory. Major areas of current faculty emphasis include conformal and scale invariant gravity theories, Weyl-geometric quantization, exact solutions in Gauss-Bonnet extended gravity, classical and quantum dynamics of the gravitational field, Hamiltonian dynamical systems, and other geometrical methods in physics. Weekly seminars and monthly joint meetings with the University of Utah relativity group provide for substantial interaction between students and faculty.

**Nuclear and Particle Physics.** Experimental research into nuclear and particle physics is conducted using national facilities providing high intensity and high energy beams at such places as LAMPF in Los Alamos, New Mexico and TRIUMF in Vancouver. Recent work includes the study of exotic nuclei with large excesses of neutrons over protons or vice versa. Collaborating with
scientists at these facilities, as well as from other institutions, has been possible to determine the masses of these exotic, rare isotopes and certain properties of their decay. The purpose of the study is to further the fundamental understanding of the nucleus and the hadronic force, as well as to provide systematic information useful to other researchers, including those working on astrophysics problems.

Worldwide, there is a lot of interest in the construction and development of new research facilities utilizing radioactive nuclear beams. USU researchers are participating in the development of these beams and the detectors associated with them. They are also participating in the construction of a Helium-jet system for inputting these exotic particles into the beam to be accelerated. Also, the researchers are interested in fundamental theoretical problems associated with the experimental discoveries being made.

**Career Opportunities**

Students who have earned a master's degree in physics are generally employed by industrial or government laboratories as either physicists or engineers. A few are hired by two-year colleges as teachers. With a PhD, the graduate will generally be hired as a physicist by an industrial or government laboratory and is employable as a professor in universities, but usually only following an appointment as a postdoctoral fellow for 1-3 years.

**Financial Assistance**

Financial assistance in the form of teaching assistantships and fellowships is awarded by the department. Research assistantships are available from research groups or individuals. Some support for teaching laboratory sections or grading papers is available. Students for whom English is not their native language are not eligible for teaching positions their first year at USU.

**Physics Courses**

505. Radiological Health and Safety. Required for authorization to utilize radioactive materials at USU, this course introduces the concepts of fundamental radioactivity, radiation detection, radiology, and practical health physics. Prerequisites: Phys 113 and Biol 125. (3F,3Sp)

525. Topics in Physics (Topic). Independent or group study of physics topics not covered in regular course offerings. (1-6)


581, 582, 583. Physics Colloquium. A series of invited lectures on specialized topics in physics and related subjects. (1F) (1W) (1Sp)

601. Introduction to Solar-terrestrial Physics. Study of Solar-terrestrial physics, including planetary magnetic fields, the interaction of the sun with planetary properties (magnetic fields and atmospheres), and an overview of ionospheric measurement techniques. Prerequisite: former or concurrent Phys 461. (3F)

602. Upper Atmospheric Physics. Study of the upper atmosphere and the physics occurring in each of the layers and zones. Prerequisite: Phys 601. (3W)

603. Upper Atmospheric Physics Continued. Continuation of Phys 602 with emphasis on atomic and molecular atmospheric physics and a study of the equatorial and polar ionosphere. Prerequisites: Phys 601 and 602. (3Sp)

614, 615, 616. Atomic Spectra, Molecular Spectra, Spectroscopic Measurements. Electromagnetic radiation arising from atomic and molecular sources treated in terms of quantum mechanical models. Laboratory and field techniques for detection and analysis of radiation from such sources. (3F) (3W) (3Sp)

621, 622, 623. Advanced Relativity. Foundations of spacetime physics. The first quarter is a survey of the basics of special and general relativity, including kinematics, mechanics, and electrodynamics in flat spacetime, the description of curved spacetime, and the Einstein equation. The remainder of the course is devoted to exact solutions, applications, tests, and the mathematical techniques of general relativity. Prerequisite: a firm background in classical mechanics and electromagnetism. (3F) (3W) (3Sp)

631. Space Science and Engineering. Survey of space and atmospheric physics, spacecraft mechanisms, guidance, communication, and telemetry systems; aeronomical and space measurement techniques; aerospace equipment design. (3F)

641, 642, 643. Theoretical Mechanics. Lagrange's equations, Hamilton's principle, Hamilton's equations, canonical transformation, Hamilton-Jacobi theory, central forces, noninertial reference frames, rigid body motion, small oscillations, relativistic mechanics including some aspects of general relativity, canonical perturbation theory, continuum mechanics. Prerequisites: Phys 341, 342, 343 or equivalent. (3F) (3W) (3Sp)

651, 652, 653. Statistical Mechanics. Thermodynamics is reviewed. The foundation of statistical mechanics and applications to ideal classical and quantum gases, blackbody radiation, ideal crystals, interacting classical gases and liquids, phase transitions, and critical phenomena are discussed. (3F) (3W) (3Sp)

657, 658, 659. Applied Plasma Dynamics. Characteristics of the plasma state and plasma generation; velocity distribution functions, collisions and Boltzmann's equation; wave modes in a plasma; transport theory; plasma devices. Prerequisite: Phys 463, or ECE 315 or equivalent. (3F) (3W) (3Sp)

661, 662, 663. Theoretical Electricity and Magnetism. Fundamental laws of electrostatics and magnetostatics; dielectric media, Maxwell's equations, time varying fields, and electromagnetic waves. Waveguides and radiation by moving charges. Prerequisites: Phys 461, 462, 463 or equivalent. (3F) (3W) (3Sp)

664, 665, 666. Solid State Physics. Elastic, thermal, electric, and magnetic properties. Considerable time is devoted to the study of conductors and semiconductors. Prerequisites: Phys 463 and 473, or instructor's consent. Concurrent registration in Phys 651 is recommended. (3F) (3W) (3Sp)

667, 668, 669. Physics of Materials. Application of microscopic (quantum) and macroscopic (classical) physics to study materials properties (e.g., bonding, structure, atomic dynamics, electrical, magnetic, thermal, optical), characterization methods, and a survey of materials. Prerequisites: Phys 451, 452, 471, 472, 473, or equivalent. (3F) (3W) (3Sp)

671, 672, 673. Quantum Mechanics. Advanced quantum mechanics stressing the formalism of states and operators in the study of quantum dynamics, angular momentum, symmetry and group theory, perturbation theory and scattering. Prerequisites: Phys 471, 472 or equivalent. (3F) (3W) (3Sp)

697. Thesis Research. Advanced research under guidance of one or more faculty members. (1-15)

699. Continuing Graduate Advisement. (1-3)

704. Ionospheric Physics. Observational and theoretical aspects of ionospheric physics. Production and loss mechanisms for the ionization, transport processes, and effects of ionospheric storms. Emphasis on the ionosphere above 100 km. (3F)

705. Atmospheric Chemistry and Photochemistry. (See Chem 705.) (3W)

706. Circulation of the High Atmosphere. Dynamics of the stratospheric and mesospheric circulation systems; gravity wave, large-scale circulation patterns of the stratosphere and mesosphere; stratospheric transport, energy transformation. Prerequisite: solid foundation in the physical sciences. (3Sp)

712, 722, 723. Nuclear Physics. Size, shape, mass formulae, low-energy nucleon scattering, the deuteron, fission, reactions, models, electromagnetic interactions, and beta decay. Prerequisite: Phys 673 or consent of instructor. (3F) (3W) (3Sp)

732. Space Science and Engineering. Survey of space and atmospheric physics, spacecraft mechanisms, guidance, communication, and telemetry
Agricultural Meteorology, Air Pollution, Atmospheric Radiation, Degree Information

Admission Requirements and mathematics courses. The requirements differ
sory committee. There are, however, departmental
requirements regarding physical and biological science courses and mathematics courses. The requirements differ depend-
ing on the area of specialization.

Departmental MS students normally complete their
MS degree under Plan A. This plan involves a thesis
based on original research conducted by the student. In
unique circumstances, an MS may be completed under Plan B. In this plan, a special report based on a library
study replaces the thesis of Plan A.

The MS candidate must pass an oral, comprehensive,
coursework examination. This examination is given by
the supervisory committee after most courses are com-
pleted. To obtain MS degrees, candidates must success-
fully defend their theses (or special library reports) before
their supervisory committees.

For the PhD degree, a dissertation, based on original
research conducted by the student, is required. To become
a PhD candidate, a student must pass a comprehensive,
written and/or oral, coursework examination. This examination is given by the student's supervisory committee when most of the courses are completed. The candidate is awarded a PhD degree following a successful dissertation defense before the supervisory committee.

Financial Aid and Assistantships

Acceptance of a student to a graduate program is independent of financial aid. Financial assistance available through the School of Graduate Studies includes University fellowships, scholarships, and fee waivers.

Each year the department awards several students a part-time teaching assistantship. Teaching assistants perform a variety of instructional functions. Research assistantships are offered by faculty members who have Utah Agricultural Experiment Station funding or research grants from other sources. Students with research assistantships assist their major professors in accomplishing the research-grant objectives.

Further Information. A graduate guidebook outlining the graduate programs, policies, and procedures in the Department of Plants, Soils, and Biometeorology may be obtained from the department.

Plant Science Courses

**650.** Seed Physiology and Production. Methods and problems of maintaining purity and identity of commercial production of field, vegetable, and flower seeds in the Intermountain West. (4F)

620 (d520). Crop Physiology. The relationship between physiological processes and yield of crops. Light interception and canopy geometry, canopy photosynthesis and respiration, carbon partitioning, and source-sink relationships. Prerequisites: Bot 440 and Math 105, or instructor's consent. Three lectures. (5Sp)

621 (d521). Crop Physiology Laboratory. Analysis of plant physiological processes which result in plant growth and crop production. Prerequisite: PSCI 520 or 620 prior to or concurrently. (25p)

635. Plant Tissue Culture: Principles and Applications. Plant tissue culture techniques used in commercial propagation, genetic improvement of crop and ornamental plants, and biosynthesis of secondary compounds. Two lectures, two labs. Prerequisite: Bot 440. (3F)


650 (d555). Weed Science. Identification of weeds, weed problems in agriculture, and methods of control. Three lectures, one lab per week. (4Sp)

655. Biochemical Basis of Herbicidal Action. Entrance, movement, and metabolism of major herbicides, and a critical study of the physiological processes affected by them. Prerequisites: Bot 440, Chem 376. (3W)

665 (d565). Crop Protection Chemicals. Preparation, properties, and uses of fungicides, insecticides, herbicides, and growth regulators. Calibration and care of application equipment. Prerequisites: Bot 560 and Ent 441, or instructor's permission. (25p)

670 (d570). Plant Breeding. Principles, techniques, and practices in breeding improved varieties of crop plants. Prerequisites: Biol 319 or PSCI 270 or instructor's approval. (3Sp)

676 (d476). Crop Ecology. Features of agroecosystems compared with natural ecosystems; input of energy and materials to manipulate agroecosystems and produce maximum, sustained quality and yield of agricultural products. Prerequisites: Bot 440, PSCI 620/620, or instructor's consent. (3W)

Soil Science Courses

575. Environmental Quality: Soil and Water. Environmental quality case studies presented through lectures and readings. Students research and present integrative solutions using soil/water sciences. Prerequisites: Soils 358 (required), and Soils 695/695, 613/613, and 665/665 (recommended). (3Sp)

605 (d505). Principles of Environmental Soil Chemistry. Chemistry of the soil matrix-soil solution interaction as related to environmental processes, emphasizing the surface chemistry and ionic equilibrium relationship. Prerequisite: Soils 358, Chem 121, or equivalent. (3W)

613 (d513). Soil Genesis, Morphology, and Classification. Morphology, development, and classification of soils. Lectures and weekly field exercises emphasize soil as a natural body on the landscape: its evolution, behavior, and interpretation. (5Sp)


**619.** Salt-affected Soils. The chemistry of salt-affected soils and its relation to soil management of irrigated systems. Prerequisite: Soils 358 or equivalent. (3W)

628 (d527). Properties and Management of Wildland Soils. Biological, chemical, and physical properties of wildland soils; site productivity and classification of wildlands; techniques for managing wildland soils and the consequences of management. (3F)

**630 (d530).** Soil Microbiology. Activities and ecology of microorganisms related to soil environment, soil fertility, soil organic matter, rhizosphere, and soil amendments. Prerequisites: general biology, organic chemistry. (3W)

**631 (d531).** Soil Microbiology Laboratory. Application of soil microbiological techniques. Two labs. Prerequisite: Soils/Micro 630/530 taken concurrently or previously. (2W)

655 (d555). Soil and Plant Nutrition. The soil, chemical, and environmental factors that affect the mineral nutrition of plants; nutrient availability, absorption, toxicity, fertilizer management, soil amendments, and water quality. Prerequisite: Soils 558. (3W)

656 (d556). Soil and Plant Nutrition Laboratory. Procedures used in determining fertility status of soils and identifying problems affecting plant growth. Prerequisite: Soils 655/655 prior to or concurrently, or with instructor's consent. (2W)

665 (d565). Applied Soil Physics. Physical relations of soils to water and climatic factors. The relation of soil water content and potential to plant growth, soil water flow, heat flow, and aeration are emphasized. (3F)

666 (d566). Applied Soil Physics Laboratory. Methods of analysis. Prerequisite: Soils 665/665 prior to or concurrently, or instructor's consent. (2F)

672 (d562). Chemistry of Aquatic Systems. Emphasis on the chemical processes occurring in natural environments. Principles of physical chemistry applied to problems involving the composition of natural waters. Prerequisite: Chem 301. (3Sp)

715. Physical Chemistry of Soils. Advanced treatment of soil physical chemistry including surface chemistry of soils. Prerequisite: Chem 306. (3F)

721. Pedology. Through discussions and readings, students explore strategies for designing and critiquing pedological research. Topics include: soil characterization, mineralogy, and landscape evolution. Prerequisite: Soils 613/613 or equivalent. (3W)

**722.** Soil Solute Processes. The course discusses mathematical description of the physical, biological, and chemical processes involved in nutrient transport and cycling in the soil system. (3Sp)
Biometeorology Courses

**541. Synoptic Meteorology.** Study and analysis of the synoptic structure of climate, with special interest in geographical distributions and practical prediction of global climates. (3W)

**625 (d525). Principles of Remote Sensing and Applications in Agriculture and Hydrology.** Techniques for field ground-based measurements of reflected and emitted radiation as well as ancillary data collection to support airborne and satellite remote sensing studies in agriculture and hydrology. (4SP)

**630 (d530). Introduction to Meteorology.** Introduction to principles of meteorology for students with science background. Treatment of the nature of storms, winds, clouds, precipitation, and atmospheric circulation. (4W)

**635. Physical Climatology.** Physical causes and effects of the various climatic regimes found upon the earth. Prerequisite: instructor's consent. (3SP)

**640. Climate Modeling.** Study of the basis and mechanisms of all types of physically-based climate models. Preparation for the climate modeling fundamentals. (3SP)

**650 (d550). Microclimate and Biophysics of Plant Canopies.** An examination of the soil-plant-atmosphere interactions which shape the microclimate of vegetated surfaces. Emphasis is directed towards understanding the fundamental principles, and nonlinear feedbacks. (3SP)

**652. Introduction to Biometeorological Instrumentation.** Provides fundamentals needed to understand, operate, and interface sensors used in environmental measurement studies. Includes laboratory for hands-on experience with several sensor types. (3W)

**653. Biometeorological Instrumentation Laboratory.** Instruction in planning and performing environmental measurements. Individual sensors (Binet 652) are combined into measurement systems. Student plans and executes an experiment and analyzes data. (3SP)

**704. Ionospheric Physics.** Observational and theoretical aspects of ionospheric physics. Production and loss mechanisms for the ionization, transport processes, and effects of ionospheric storms. Emphasis on the ionosphere above 100 km. (3F)

Plants, Soils, and Biometeorology Courses

**516. Methods in Biotechnology: Cell Culture.** Laboratory-intensive course in basic and applied methods of culturing cells (mammalian, insect, plant) and methods of fusing and transforming cells. Prerequisites: Biol 125 or ADVS 316 or equivalent, or permission of instructor. (3W)

**524. Methods in Biotechnology: Protein Purification Techniques.** Laboratory oriented course designed to provide basic knowledge in protein purification, analysis, and its scale up. Prerequisites: Chem 370 or Biol 319 and Micro 301 or equivalent, ADVS 316, or permission of instructor. (3SP)

**526. Methods in Biotechnology: Molecular Cloning.** Laboratory oriented course in molecular cloning techniques such as DNA cloning, genetic probes, PCR, DNA sequencing. Prerequisites: Chem 370 or Biol 319 and Micro 301 or equivalent, ADVS 316, or permission of instructor. (3F)

**689. Seminar.** Oral and written reports by graduate students. (1F, W, Sp, Su)®

**690. Special Problems.** (1-5F, W, Sp, Su)®

**697. Research and Thesis.** (1-15F, W, Sp, Su)®

**699. Continuing Graduate Advisement.** (1-12F, W, Sp, Su)®

**789. Seminar.** (1-3F, W, Sp)®

**790. Special Problems.** (1-8F, W, Sp, Su)®

**797. Research and Thesis.** (1-16F, W, Sp, Su)®

**799. Continuing Graduate Advisement.** (1-12F, W, Sp, Su)®

*Taught 1995-96.

**Taught 1996-97.

® Repeatable for credit. Check with major department for limitations on number of credits that can be counted for graduation.

1Parenthetical numbers preceded by d indicate a dual listing.

Department of
Political Science

College of Humanities, Arts, and Social Sciences

Head: Professor Randy T. Simmons, environmental politics and policy, public choice
Office in Main 320A, 797-1306

Assistant Head: Associate Professor Carolyn Rhodes
Graduate Program Coordinator: Associate Professor David B. Goetz

Professors William L. Furlong, Latin America, Central America, democratization, development; H. Preston Thomas, public law; Associate Professors Peter F. Gaiderist, parties, elections, interest groups, research methods, statistics; David B. Goetz, political economy, social choice, comparative politics; Roberta Q. Herzberg, public choice, health policy, public policy; Amal Kawar, comparative politics, Middle East, women and politics; Carolyn Rhodes, international relations, comparative politics, European community, trade, Veronica Ward, international relations, social choice, global environmental issues, conflict and cooperation; Associate Professors Jing Huang, Asian political thought, comparative politics, development; Michael S. Lyons, U.S. government, Congress, public policy, elections; Peter McNamara, political thought.

Degrees offered: Master of Science (MS) and Master of Arts (MA)

The USU graduate program in Political Science offers Master of Arts and Master of Science degrees. The program emphasizes political economy—the intersection of politics and economies. Within the framework of political economy, the program involves study in the traditional subfields of international relations, comparative politics, U.S. politics, political theory, and public policy. The curriculum is designed principally to prepare students for
PhD programs in Political Science, for policy analysis positions in government or in the private sector, and for teaching positions at the college or university level.

The program requires completion of 48 graduate credit hours, including 45 hours of coursework and a 3-credit "Plan B" thesis. Courses are distributed across four program sections: Foundations, Comparative and International Political Economy, U.S. Political Economy, and Interdisciplinary Perspectives.

The MA degree requires proficiency in a second language. The MS degree requires mathematical or statistical proficiency. Students may need to take additional courses to satisfy these requirements.

Assistantships

The department appoints a number of teaching assistants, each with a $6,246 annual stipend. Appointments are for one year but renewable for a second year. Research assistantships and government internships are sometimes available as well. Applications are available from the Political Science Department and are due on March 1.

Admission Requirements

Applicants must have a BA or BS degree. An undergraduate GPA of 3.0 or better, or a GPA of 3.5 or better over the last 90 credit hours of undergraduate coursework is required. Students must have quantitative, verbal, and analytical GRE scores at or above the 50th percentile. Applicants with very high GPAs and other exceptional supporting materials may petition for admission with deficient GRE scores. The graduate admissions committee will review petitions individually.

International Student Program. International students must receive a score of 550 or better on the TOEFL exam.

Due to limited space, acceptance into Political Science graduate programs is not guaranteed, even for students who meet admission requirements. Moreover, all students are expected to perform at high levels throughout their program. Any student receiving a C grade or lower for any course at any level or a grade point average below 3.0 for a given quarter will be placed on academic probation. Receipt of two grades of C or lower or a grade point average below 3.0 for two quarters will result in termination from the program.

Course Requirements

All MS or MA candidates must take the following three foundations courses: PolSci 601, 603, and 604. Students must also complete a minimum of 33 credits from among those listed in the following three sections:

Comparative and International Political Economy. Students must take at least two courses from the following: PolSci 622, 623, 625, 627, 628, and 681.

U.S. Political Economy. Students must take at least two courses from the following: PolSci 610, 612, 614, 615, 618, and 681.

Interdisciplinary Perspectives. Students may use no more than two courses from the following to satisfy the 48-credit requirement: Econ 516, 540, 550, 580; and Anthr 505 or 652.

With adviser approval, students may substitute other interdisciplinary courses for those listed above. Also with approval, they may substitute one readings and confer­ence or special topics course for another program course. Upon completion of their coursework, students enroll in PolSci 697 to receive credit for their thesis.

Political Science Courses

516. Economic Transformation of Russia and Eastern Europe. Description and analysis of the contemporary economic systems of Russia and Eastern Europe, with emphasis on problems of economic policy and central planning. (3SP)

591. Campaign Internship. A quarter campaign internship. Instructor approval required. (2-15)

592. Washington Internship. A quarter congressional, administrative, or legal internship in Washington, D.C. Instructor approval required. (2-15)

595. State Government Internship. A quarter legislative, lobbying, or administrative internship in the state government of Utah or those of any other state government. Instructor approval required. (2-15)

594. Administrative Internship. A quarter administrative internship at the local or state level. Instructor approval required. (1-15)

601. Scope and Methods in Political Science. A graduate survey of the philosophy and methods of political analysis. Topics ranging from the methodology of inquiry to elementary statistical methods will be covered. (4)

603. Political Theory, Political Economy, and Capitalism. Provides an introduction to the study of political economy by considering the connections among political theory, political economy, and capitalism. (4)

604. Public Choice. Introduction to applying the microeconomic theory of markets to political processes. (4)

610. Politics and Public Policy. Explains public policies as rational expressions of political self-interest and explores the relationship between self-interest and values such as "equity" and "efficiency" in policy. (4)


614. Parties, Voters, and Elections. The role of political parties and party systems as intermediaries of electoral choice in U.S. politics. Comparisons with other nations' party systems will be made, although the course will focus on the transformation of parties and elections in the U.S. (4)

615. Political Incentives in United States Government. A survey course exploring political incentives in elections, political representation, and lawmaking in U.S. national government. (4)

618. Natural Resources and Environmental Policy: Political Economy of Environmental Quality. Political and economic theory applied to the analysis of natural resource allocation conflicts and U.S. policies enacted to resolve such conflicts. (4)

622. International Political Economy. Reading seminar on theory and methods in the interplay of politics and economics in international relations. (4)

623. Political Change and Development: Middle East. Study of Middle Eastern regimes, political cultures, and political developments. (4)

625. International Trade Policy. Major trends in theories regarding the politics of international trade, with special focus on U.S. trade policy, the international GATT regime, and the European Community. (4)

627. Comparative Political Change/Development. Examines different approaches in the study of comparative politics. Emphasizes how scholars, from various perspectives, view the origins of political regimes and political development/changes under these regimes. (4)
Department of Psychology

College of Education

Head: To be appointed
Office in Emma Eccles Jones Education 487E, 797-1460

Graduate Program Coordinators: Research and Evaluation Methodology Program—Professor Blaine R. Worthen, research methodology, educational psychology; Professional-Scientific Psychology Program—Associate Professor David M. Stein, clinical

Professors Frank R. Asstone, developmental; Michael R. Bertoch, clinical/counseling; Keith T. Checketts, school psychology and counseling, research methodology; Carl D. Cheney, physiological; John R. Cragun, industrial; Marvin G. Fifield, school and counseling; Cecilia H. Foxley, counseling, human relations; J. Grayson Osborne, behavior therapy, child; Richard N. Roberts, developmental; Charles L. Salzberg, applied behavior analysis; Sebastian Striefel, clinical child; Karl R. White, research methodology; Professors Emeriti Arden F. Frandsen, educational psychology; Richard B. Powers, experimental social; David R. Stone, learning, educational psychology; E. Wayne Wright, counseling; Associate Professors Tamara J. Ferguson, social psychology; Kenneth W. Merrell, school psychology; Lani M. Van Dusen, educational psychology, research methodology; Associate Professors Emeriti William R. Dobson, clinical; Elwin C. Nielsen, clinical and school; Assistant Professors Susan L. Crowley, counseling; Xitao Fan, psychometrics, quantitative methods; Research Assistant Professor Mark S. Innacenti, school psychology; Assistant Professor Emeritus J. Whorton Allen, counseling; Adjunct and Clinical Faculty J. Milo Andrus, psychiatry; Ann M. Berghout Austin, infancy through childhood; Richard D. Baer, experimental child; Carolyn G. Barcus, counseling; Byron R. Burnham, qualitative evaluation methods; David W. Bush, clinical/counseling; Curtia R. Canning, psychiatry; Glendon W. Casto, developmental; Phyllis Cole, clinical child/school; Mary E. Doty, clinical; Margaret M. Dyreson, educational psychology; Laura B. Fisher, psychiatry; Mariynne T. Glattfelter, clinical; Richard D. Gordin, Jr., sport and exercise psychology; Bruce R. Johns, clinical child; Randall M. Jones, family research management; Joan A. Kleineke, counseling and personnel services; Glen H. Mau, counseling; Mark A. Nafziger, counseling psychology; D. Kim Openhawen, marriage and family therapy; Calvin R. Petersen, clinical; Lori A. Raggman, developmental; Thomas R. Schenkenberg, neuropsychology; Patricia L. Truax, neuropsychology, crisis intervention; Leland J. Winger, Jr., clinical; Jean Wollam, educational psychology

Degrees offered: Master of Science (MS), Master of Arts (MA), Doctor of Philosophy (PhD)

Specializations: MS, MA—School Psychology, School Counseling; PhD—Combined Professional-Scientific Psychology (Clinical, Counseling, and School), Research and Evaluation Methodology

Admission Requirements

The department brings only top-level students into its programs and has generally adhered to the following as minimum requirements for acceptance for both PhD and MS programs: GRE verbal and quantitative test scores at or above the 40th percentile, GPA of at least 3.2 in undergraduate psychology and/or 3.5 in graduate psychology at an accredited university, and excellent recommendations.

The application deadlines are February 1 for the following fall quarter for the professional-scientific program and March 1 for the school psychology program. Students are considered only for fall quarter admission to these programs. The other programs review applications year-round and admit students to begin in whatever quarter is judged appropriate by the department.

Prerequisites for Matriculation

A student should have had undergraduate courses (or possess equivalent background knowledge) in each of the following areas of psychology before acceptance into the Department of Psychology PhD program: general psychology, human development, analysis of behavior, elementary statistics, history and systems of psychology, physiological psychology, and social psychology. It is strongly suggested that students who are admitted to the program without having established competence in all of these core undergraduate areas plan on remedying such...
deficiencies before they undertake substantial graduate work in the program.

**Degree Programs**

**Master of Science.** The MS degree provides extensive academic and experiential background in school counseling and/or school psychology. Emphases include diagnosis and evaluation, consultation with schools and other institutions, and a variety of counseling intervention strategies. Research skills and practical experience are emphasized. Certification as school counselors and school psychologists is recommended to the State Office of Education.

**Master of Arts.** The MA degree has language requirements beyond the MS. See page 31 of this catalog.

**Doctor of Philosophy.** Students are admitted to one of two specialization areas.

1. **Professional-Scientific Psychology (APA Full Accreditation).** The Combined Program in Professional-Scientific Psychology is defined by APA as a combination of clinical, counseling, and/or school psychology. This program is designed to provide the student with a basic background in these areas, including extensive practicum experience in community agencies and the departmental community clinic. Although practitioner oriented, the program also provides the student with firm scholarly and research skills, which may serve as a basis for research and other scholarly work in areas of interest.

2. **Research and Evaluation Methodology.** The Department of Psychology, in cooperation with the College of Education's Interdepartmental Doctoral Program, offers a specialization in research and evaluation methodology, leading to a PhD in psychology. This program is designed to produce specialists in research and evaluation methodology capable of contributing to the knowledge base in psychology and education and of evaluating programs, products, and processes employed in these two fields. While satisfying the department's general requirements, students may design their programs to become specialists in evaluation, applied research, basic research, or functional combinations of these roles.

**Course Requirements**

All PhD candidates must meet the following general core requirements regardless of specialty emphasis: (1) completion of research requirements as follows: (a) submitting an article for publication in a recognized journal, (b) presenting research findings at a professional meeting, (c) completion of the doctoral dissertation; (2) completion of the statistics and research core. Internship is required for professional-scientific students only. Writing a grant proposal is required for research and evaluation methodology students only.

MS candidates establish individual course requirements in cooperation with their supervisory committees.

**Research**

The department is heavily involved in research. Examples of faculty research interests include behavioral medicine, neuropsychology, therapeutic effectiveness, personality and social development in children and adolescents, educational research methodology, transcultural diagnosis, eating disorders, and hearing loss. Mentorship in research is available at both the undergraduate and graduate levels.

**Financial Assistance**

Departmental support and grant support are available to graduate students and are awarded on a competitive basis. Students requesting financial support should apply to the department by February 1. Acceptance to pursue graduate study does not guarantee the student financial aid.

**Career Opportunities**

Many job opportunities are available in the field of psychology especially at the graduate level. One hundred percent of the department's graduates have taken jobs in university positions, have established private and public practice in psychotherapy or public schools, or have furthered their education in PhD or postdoctoral work.

**Psychology Courses**

515. Psychology of Aging. To acquaint students with the psychological process changes in the elderly, the coping mechanisms used by the elderly, and the research related to the above. (4)

520. Introduction to Counseling and Guidance. An introduction to the fundamental counseling and guidance principles and theories that are applicable in various settings in which they are practiced. Prerequisite: Psy 101. (3F, 3P)

590. Independent Study. Individual discussion and intensive study of a particular problem or area. Prerequisite: instructor's consent. (1-3F, W, Sp, Su)

591. Independent Research. Experiments and demonstration projects are conducted and reported. Prerequisite: instructor's consent. (1-3F, W, Sp, Su)

593. Instructional Apprenticeship. Training and practical experience in applying the techniques of contingency management to teaching. Prerequisite: instructor's consent. (1-3F, W, Sp, Su)

595. Introduction to Evaluation: Evaluation Models and Practical Guidelines. Alternative approaches and practical guidelines for conducting evaluation studies. Impacts of social, political, and ethical issues on evaluation are addressed through case studies and simulations. (3F, Su)

605 (d505). Psychological Aspects of Sports Performance. Psychological theory and principles applied to sports. Includes motivational techniques, psychological evaluation, stress and anxiety in sports, personality and sports performance. (3P)

606. Human Development: Adult. Characteristics of adult learners; explores the continuing development of adults from ages 18 to 65+ especially in relationship to lifelong education and potential for positive growth. (3)

610 (d510). History and Systems of Psychology. Theoretical and historical developments in psychology with primary emphasis on nineteenth and twentieth century developments, although earlier precursors are also considered. Prerequisite: Psy 101. (4P)

615. Behavioral Assessment and Single-subject Analysis. Theoretical, methodological, and practical issues related to clinical behavioral assessment and treatment-oriented research are stressed. Actual conduct of behavioral assessment is included. (3F)

616. Behavioral Treatment of Childhood Psychological Disorders. Theoretical and methodological issues and practical applications of behavioral approaches to treating deviant child behavior. (3W)

620. Principles of Counseling and Psychotherapy. Basic principles of counseling and psychotherapy including unique as well as common elements of general therapeutic relationships, essential interviewing skills and techniques, and related professional ethics. Prerequisite: BS degree in psychology or related field and instructor's consent. Prerequisites: Psy 321 and 421 (3P, Su)

**622. Group Counseling and Psychotherapy: Theory and Practice.** An introduction to the theory of group counseling and psychotherapy with
illustrative experiences to show how theory may be applied. Prerequisites: Psy 620 and 635. (3Sp)²

632. Theories of Personality and Psychotherapy. Survey of various theoretical approaches to personality and psychotherapy. (3W)

624. Workshop in Guidance. A faculty or part of a faculty in a school district studies, evaluates, and attempts to improve the use of the school's resources for more effective guidance in its several phases. (1-6)²

625. Graduate Cooperative Work Experience. Professional level of educational work experience in a cooperative education position for graduate students. (1-15F,W,Sp,Su)²

**626. Career Development: Theory and Practice. A consideration of career patterns and factors influencing career development and career effectiveness. (3W)

**629. Nonstereotypic Approaches to Counseling. Designed to help counselor trainees become more aware of the detriments of stereotyping and to provide them with intervention models, methods, and programs which they can use in working with a wide variety of clients. Prerequisites: Psy 620, 633/533, 635 or consent of instructor. (3W)²

630. Group Testing. Investigation of various group tests available to measure interests, achievement, aptitudes, personality, etc. Administration, scoring, and interpretation of group testing batteries are emphasized. Prerequisite: Psy 633/533 and instructor's consent. (3W)²

631. Intellectual Assessment. Training and supervised experience in administering and interpreting individual intellectual ability tests such as the Wechsler and Stanford-Binet scales. Prerequisites: Psy 633/533 and instructor's consent. (3F)²

**632. Psychological Assessment of Personality and Mood/Affect. Research bases and applications of contemporary psychological assessment techniques of personality and mood/affect. (3Sp)²

633 (D553). Psychometrics. Evaluation, interpretation, and use of tests of intelligence, aptitudes, interest, personality, and adjustment. Prerequisites: Psy 101, 380. (5F)

604. Consultation and Group Processes: Intervention at the System Level. Approaches to psychological consultation with teachers, parents, and within organizations. Overview of group processes theory as it relates to various forms of consultation. (3F)²

635. Practicum in Counseling and Psychotherapy. Beginning practicum activities in counseling and psychotherapy. Analysis of tape-recorded interviews, role playing of simulated interview situations, and actual counseling sessions with student subjects. Prerequisites: Must be taken concurrently with Psy 620 unless the student has had a previous course in principles and techniques of counseling. Instructor's consent required. (3F)²

636, 637. Practicum in Counseling and Psychotherapy. Supervised practicum in individual, family, and group counseling, and psychotherapy, psychological assessment, and consultation. Includes client problems and settings appropriate to clinical, counseling, and/or school psychology. Prerequisite: Psy 620. First-year master's students should take Psy 656; Psy 657 is for second-year master's students. (SP, W, Sp, Su)²

641. Psychoeducational Assessment. Training and supervised experience in administering and interpreting selected cognitive ability, academic achievement, and other psychoeducational instruments to school-aged and preschool-aged subjects. Prerequisite: Psy 631 or instructor's consent. (3W)²

646. Professional Issues in School Counseling and School Psychology. Role and function of school counselors and school psychologists; historical foundations; legal, ethical, and professional issues relevant to school counselors and school psychologists. Prerequisite: graduate standing in psychology or instructor's consent. (3Su)

650 (D550). Interdisciplinary Workshop. (1-3)²

654. Moral Development in the Family. In the context of family and human development, empirical and interdisciplinary information is presented in the areas of emotional, cognitive, and interpersonal aspects of morality. (3Sp)

659. Psychology and the Deaf and Hard of Hearing. Psychological theories and research used to describe the deaf and hard of hearing. Exploration of basic questions concerning these views. (3W)

660. Correlation and Regression in Psychology and Education. Various bivariate correlational techniques, partial correlation, introduction to multiple regression and factor analysis. Prerequisite: Psy 380. (3W, Su)

661. Inferential Statistics in Psychology and Education. Hypothesis testing, critical ratios, and t-tests; analysis of variance and covariance.
712. Developmental Psychology. An advanced survey of topics in developmental psychology including cognitive, social, perceptual, emotional, and language development. (3W)

*713. Social and Organizational Bases of Behavior. Provides entering graduate students with a common background in social and organizational psychology. Emphasis will be on applying theoretical knowledge to social/organization problems. (5Sp)

725. Professional Ethics and Standards. Designed to train future psychologists to operate within the professional ethics and standards of psychology. (3F)

727 (627). Psychopathology I. First part of two-course sequence (727, 728). Examines contemporary models and classification of mental disorders. Emphasizes anxiety, somatoform, dissociative, psychophysiological, personality, and psychosexual disorders. Prerequisites: Psy 101, matriculation in the Pro-Sci doctoral degree program, and instructor's consent. (3)

728 (628). Psychopathology II. Second part of two-course sequence (727, 728) with special emphasis on substance abuse/dependence, eating disorders, mood disorders, schizophrenias, and organ brain syndromes. Prerequisite: Psy 727. (3)

**732. Advanced Psychological Assessment. Emphasizes projective assessment techniques, especially the Rorschach and integrative psychological report writing. Prerequisite: Psy 632. (3Sp)²

735. Practicum in School Psychology. Doctoral-level practicum in a school setting. Supervised experience in developmental, learning, and school related problems. Appropriate assessment and consultation with teachers, administrators, parents, and other related individuals. Prerequisite: permission of program chair. (3F, W, Sp, Su)²

736. Practicum in Counseling Psychology. Doctoral-level practicum in a counseling setting. Supervised experience in individual, group, and family counseling. Appropriate assessment and consultation. Prerequisite: permission of program chair. (3F, W, Sp, Su)²

737. Practicum in Clinical Psychology. Doctoral-level practicum in a clinical setting. Supervised experience in individual, group, and family psychotherapy. Includes psychological assessment and consultation. Prerequisite: permission of program chair. (3F, W, Sp, Su)²

747. Practicum Supervision. Fourth-year doctoral students obtain experience in supervising entering graduate students in learning to do counseling, psychotherapy, and testing under the control of a faculty advisor. (1-3F, W, Sp, Su)²

750. Interdisciplinary Workshop. (1-3Sp) ²

767. Designing Educational and Psychological Research. Helps students understand research design concepts and become competent in interpreting research findings, basing studies on prior research, conducting doctoral-level seminars, and critiquing research reports. Prerequisites: Edu/Psy 660, 661, 667. (3Sp, Su)

*770 (670). Grantsmanship in Education and Psychology. Students learn to identify funding sources, select strategies for seeking resources, and write proposals for research, development, training, and service activities in education, psychology, and related fields. Prerequisite: Psy 667. (3-5Sp)

781. Seminar. Designed for in-depth review, presentation, and discussion of special, contemporary topics. Offered as needed by designated staff and/or visiting consultant-lecturers. (1-3)²

*782. Neuropsychological Assessment Workshop. A discussion-presentation of neurological syndromes and the various techniques of diagnosis and assessment. Prerequisite: Psy 632. (3)²

**784. Psychopharmacology. Provides psychology graduate students with a basic working knowledge of the field of psychopharmacology and the medical use of psychotropic drugs. Prerequisite: Psy 632. (2W)²

790. Independent Study. Individual discussion and intensive study of a particular problem or area. Prerequisite: instructor's consent. (1-3F, W, Sp, Su) ²

791. Independent Research. Experiments and demonstration projects are conducted and reported. Prerequisite: instructor's consent. (1-3F, W, Sp, Su) ²

795. Internship. One-year, supervised, full-time internship required of doctoral candidates in professional psychology (clinical, counseling, and/or school psychology). Prerequisite: all doctoral coursework completed, with the possible exception of the dissertation if approved by the student's committee, prior to initiating the internship. (1-6F, W, Sp, Su) ²

797. Dissertation. (1-18F, W, Sp, Su) ²

799. Continuing Graduate Advisement. (1-12) ²

³ Repeatable for credit. Check with major department for limitations on number of credits that can be counted for graduation.

*Taught 1995-96.

**Taught 1996-97.

1Parenthetical numbers preceded by d indicate a dual listing; parenthetical numbers preceded by an f are the former course numbers.

²These courses can be taken only by psychology graduate students.

Department of Rangeland Resources

College of Natural Resources

Head: Professor John C. Malechek, range animal nutrition
Office in Natural Resources 210, 797-2471

Professors James E. Bowns, range ecology; Martyn M. Caldwell, ecophysiology; Fred D. Provenza, range animal production; Neil E. West, range ecology; John P. Workman, range economics; Adjunct Professor Douglas A. Johnson, ecophysiology; Professors Emeriti Thadis W. Box, resource management; Don D. Dwyer, range management; Philip J. Urness, range-wildlife relations; Associate Professors Roger E. Banner, extension; Christopher A. Call, range improvements; James P. Dobrowski, range watershed management; B. E. (Ben) Norton, range ecology; G. Allen Rasmussen, extension; Adjunct Associate Professors Kenneth C. Olson, range animal nutrition; James A. Pfister, poisonous plants, animal nutrition/behavior; Michael H. Ralphs, poisonous plants, livestock grazing behavior; Extension Associate Professor Charles W. Gay, international range management; Assistant Professors D. Layne Coppock, livestock production systems; Eugene W. Schupp, plant population ecology; Adjunct Assistant Professors Dale L. Bartos, ecology; Mark W. Brunson, natural resource sociology; Thomas A. Jones, native grass breeding and genetics

Degrees offered: Master of Science (MS), Doctor of Philosophy (PhD) in Range Science and in Range Ecology.

Admission Requirements
See general admission requirements, pages 25-26. The program of instruction and research leading to graduate degrees in range science is available only to students meeting high scholastic standards who are accepted by the departmental faculty. Students desiring entrance to these graduate programs should contact the department head for information concerning eligibility.

A range science baccalaureate major is not required for admission; deficiencies in course background may be overcome by passing appropriate undergraduate courses, at the discretion of a student's supervisory committee. Proficiency in a foreign language, or satisfactory performance over a set of courses in an acceptable area of emphasis, is required for the PhD.

Degree Requirements
The MS may be obtained with either a Plan A or Plan B program, as described on pages 30-31. The Plan B (nonthesis) option is recommended for professional range managers who do not desire research training. Comprehensive exams are required in the doctoral program. A graduate student handbook outlining the graduate program policies and procedures is available from the department.

Research
Cooperation with other departments and research centers of the University and with government collaborators permits strong graduate programs in all phases of range-related sciences. Particular mention should be made of the University's Ecology Center, in which the Rangeland Resources Department is very active; the Utah Agricultural Experiment Station, which has a full program in both applied and basic range research; the Center for Water Resources Research, which sponsors water-shed research; the Utah State Wildlife Resource program, which cooperates in big game-range research; the U.S. Forest Service Intermountain Forest and Range Experiment Station, which maintains a research center on the campus for range and watershed research; and the Agricultural Research Service, which works in range plant improvement, genetics, and poisonous plants. The Institute for Land Rehabilitation, located within the department, acts as an information clearinghouse and offers directed studies in land reclamation, especially of semiarid rangelands. The International Pastoral Production Institute, also located within the department, offers training in production systems for developing nations.

Natural Resources Courses
Natural Resources courses 501, 576, 577, 601, 611/511, 643, 644, and 645 are listed on page 99.

Rangeland Resources Courses
508. Rehabilitation of Drastically Disturbed Arid Land. Considers scientific principles, analysis of problems, and application of methods for rehabilitating drastically disturbed lands with an emphasis on the arid West. Prerequisites: RLR 300, 386. (3F)

510. Conflict Management in Natural Resources. Introduction to conflict management techniques for those involved in natural resources. Includes active class participation in learning to deal with natural resource conflicts. (3Sp).

512. Tropical Savanna Ecosystems. Worldwide survey; influences of fire, grazing, and drought on productivity and structure in relation to utilization by wildlife and domestic livestock; techniques for manipulation or improvement. (3F)

523. International Extension Planning and Appropriate Technology. Discussions and readings that explore the institutional and organizational requirements necessary for planning and implementing successful natural resources related programs. Prerequisites: RLR 529, 563. (3W)

524. Range Management Project Planning and Implementation in Developing Nations. Describes planning processes and surveys natural resources management project activity in LDCs of major world aid donors. Discusses project implementation problems and solutions. Prerequisite: RLR 300. (4Sp)

529. Range Management in Pastoral Societies. Strategies for sustained utilization of rangelands and related resources by pastoral peoples living in various climatic zones, biogeographical regions, and cultural systems. Prerequisite: RLR 300. (3F)

541. Range Vegetation Analysis for Livestock and Wildlife. Methods and analytical procedures for measuring and assessing vegetation used by livestock and wildlife for forage and cover. Lab fee. Prerequisites: RLR 300 and 386; Stat 201. (3F)

561. Wildland Ecosystems. Structure, function, dynamics, and management of wildland ecosystems, with emphasis on those of North America. Prerequisites: RLR 386, general soils, plant taxonomy, and College of Natural Resources summer camp. (5W)

563. Range Vegetation Manipulation and Management. Changing composition and improving productivity of range vegetation for multiple uses by use of biological, chemical, mechanical, and pyric methods. Prerequisites: RLR 300, 386; and College of Natural Resources summer camp. (4W)

565. Range Resource Economics. Principles of production economics as they apply to problems encountered in the use of natural resources. Emphasis is on the application of economic principles to problems in managing private and public range resources. Prerequisites: Econ 200, RLR 300, NR 380. (3F)

568. Rangeland Appraisal. The systematic process of determining the fair market (dollar) value of range resources used for livestock, big game, recreation, cropping, and development purposes. Prerequisite: prior or concurrent registration in RLR 565 or equivalent. (3F)

570. Range Inventory and Management Planning. Inventory of soils, vegetation, water, wildlife, and recreation resources of a selected ranch operation and development of a detailed management plan. Techniques apply to management of private and public lands. Prerequisites: RLR 565, 565; College of Natural Resources summer camp; and range science graduate senior. (5Sp)

586. Poisonous Range Plants Affecting Livestock. Poisonous plants of rangelands and their effects on grazing animals, especially livestock. Management practices to reduce or prevent poisoning. (3W)

600. Management of Rangelands for Grazing. Sequel to Principles of Range Management, presenting more detailed treatment of the ecology of range management, with particular emphasis on grazing systems. Prerequisite: RLR 300. (4W)

607 (d597). Range Wildlife Relations. A senior, graduate course that explores interactions on rangelands between wild and domestic ungulates as well as other wildlife forms around the world but with emphasis on western North America. Prerequisite: RLR 300. (4W)

615. Stress Physiology of Rangeland Plants. Responses and adaptations of plants to stresses common in arid and semi-arid environments: drought, herbivory, nutrient deficiencies, salinity, toxic ions, extreme temperatures, and stress interactions. Prerequisite: Bot 440 or equivalent. (4Sp)

642. Vegetation Analysis. Advanced treatment of vegetation sampling and analysis at the intra-stand scale, primarily for research purposes. Prerequisites: RLR 541 or equivalent; Stat 301 and 502, CS 241. (4Sp)
**655. Synecology.** Advanced treatment of the principles of community and ecosystem structure, function, and control. Prerequisite: Introductory ecology and soils. (3W)

680. Seminar. Review of current research by graduate students and faculty. (1F, W, Sp)®

681 (f598). International Range Management Seminar. Weekly seminar on aspects of range management in foreign countries. (1W)®

687. Ecology Seminar. The Ecology Center schedules seminars throughout the school year with ecologists from other institutions participating. Ecology majors are required to attend a minimum of 10 such lectures. (1F)®

690. Readings and Conference. (1-3F, W, Sp, Su)®

691. Special Topics in Range Science. Gives graduate students the opportunity to discuss a topic in range science not covered in other classes or to review recent literature. (1-3)®

692. Special Topics in Ecology. To discuss a topic of ecology not covered intensively in other classes or to review recent literature. (1-3)®

693. Special Topics in Physiological Ecology. To discuss a topic of physiological ecology not covered intensively in other classes, or to review recent literature. (1-3)®

694. Special Topics in Range Wildlife Relations. To discuss a topic of range wildlife relations not covered intensively in other courses, or to review recent literature. (1-3)®

697. Thesis Research. Original research for the MS degree on a problem in rangeland resources. (1-15F, W, Sp, Su)®

699. Continuing Graduate Advisement. (1-3)®

703 (f603). Plant-Herbivore Interactions. Considers our current understanding of fundamental process involved in plant-herbivore interactions; emphasis on tolerance and avoidance of herbivory by plants, and diet selection, intake, and habitat use by herbivores; implications to management are discussed. (4W)

715 (f610). Physiological Ecology of Plants. Plant response to environmental factors, includes environmental biophysics, physical and physiological factors influencing productivity, water use, resistance to stress, reproduction, and establishment of plants. (4F)

721 (f621). Physiological Ecology of Plants Practicum. Methodology and analysis; includes measurement of plant microclimate, and assessment of plant parameters such as energy balance, gas exchange, productivity, and water status. Prerequisite: RLR 715. (2)

730 (f630). Population Ecology of Plants. Dynamics of the numbers of individual plants as influenced by seed dispersal and dormancy, seedling recruitment; intra- and intra-specific competition; sexual vs. asexual reproduction. (3W)

731. Developing Careers in Research. Seeking research positions, research funding, the grant proposal and publication processes, research directions and career paths, budgeting, the tenure process, and research outside of universities. (2W)

**742 (f641). Vegetation Classification/Ordination.** Advanced treatment of vegetation sampling, analysis, classification, and ordination at the intersand and landscape levels; primarily for research workers. Prerequisites: RLR 541 or equivalent, Stat 361, CS 241. (3Sp)

**765 (f665). Range Economic Analysis.** Economic factors affecting land management practices, particularly rangelands and range operations. Prerequisite: RLR 565. (2W)

**775 (f675). Range Animal Nutrition.** Ruminant nutrition and productivity treated in an ecological context. Nutritional aspects of animal-plant interactions for both domestic and native ungulates are considered. Courses recommended: basic courses in ruminant nutrition, plant or animal ecology, and statistics. (3F)

**776. Techniques in Range Animal Nutrition Research.** Hands-on experience with major techniques used in assessing nutritional status of grazing ruminants. Courses recommended: current or past registration in RLR 775, basic courses in ecology and statistics. (3F)

797. Dissertation Research. Original research and study for the PhD degree on a problem in range science. (1-15)®

799. Continuing Graduate Advisement. (1-3F, W, Sp, Su)®

*Taught 1995-'96.
**Taught 1996-'97.
® Repeatable for credit. Check with major department for limitations on number of credits that can be counted for graduation.
1Parenthetical numbers preceded by d indicate a dual listing; parenthetical numbers preceded by an f are the former course numbers.

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**Department of Secondary Education**

**College of Education**

Head: Professor William Strong, English and reading education
Office in Emma Eccles Jones Education 330C, 797-2222

Professors James S. Cangelosi, mathematics education, evaluation, classroom management; Michael W. Heikkinen, science education; Richard S. Knight, social studies education; Izar A. Martinez, administration, teacher certification, multicultural education; Walter L. Saunders, science education; James P. Shaver, research and statistics, social studies education; Professors Emeriti Ross R. Allen, mathematics education, comparative education; Eldon M. Drake, journalism, general student teaching; Kenneth C. Farrer, curriculum development; Associate Professor Kay Beth Camperell, reading; Associate Professor Emeritus Varnell A. Bench, extension, administration and supervision; Assistant Professor Dalphia R. Pierce, instructional methodology, curriculum, supervision, field experience

Degrees offered: Master of Education (MEd), Master of Science (MS), Master of Arts (MA); the Secondary Education Department participates in the Interdepartmental Doctoral Program in Education, Doctor of Education (EdD) and Doctor of Philosophy (PhD)

Master's Degrees

The master's degree programs are designed to provide experience for those preparing to become master teachers, public school supervisors, or curriculum specialists. Each program provides a core of experience in education and psychology with associated work in specialized subject matter in the candidate's field.

Students completing work leading to any one of the three master's degrees take University-wide courses with specialization in one of the subject areas listed above, which can be adapted for instruction in secondary school classrooms.

Students enrolled in any of the master's programs take a required core: SecEd 604, 615, 619; Educ 641, and Educ 666 or 667. Students enrolled in the MS program must take Psy 636 as part of the core. MEd students take SecEd 600 and elect three credits from the following clusters: Psy 666 or FHD 683; SecEd 670, 671, or Educ 669; SecEd 610, 612, or 614; SecEd 624 or 638. All of the department's programs provide students with up to 21 credits of additional supporting coursework in an area approved by the student's committee; areas typically chosen include art, business, English, gifted and talented, mathematics, music, science, and social studies. The MEd requires a creative project while the MA and MS require a thesis. For a more specific description of the various degree programs, consult the department.

Doctoral Programs (PhD and EdD)

The department participates in the College of Education's Interdepartmental Doctor of Philosophy (PhD) and Doctor of Education (EdD) degree programs. For information about areas of specialization, emphases of study, research sponsored, admission requirements, and procedures to follow, see pages 35-37 of this catalog.

Admission Requirements

See general admission requirements (pages 25-26). Students applying to a master's program must have quantitative and verbal GRE scores at or above the 40th percentile and at least one year of teaching experience and a valid secondary teaching certificate or comparable professional experience.

Applications are considered quarterly. Applications will not be considered until all required information is received by the School of Graduate Studies.

Financial Assistance

Both departmental support and grant support are occasionally available to graduate students pursuing full-time study on campus. Such financial support typically is through assistantships, which carry some teaching, research, or supervisory obligations. Such awards are made on a competitive basis. Students who want to be considered for financial aid should apply to the department no later than February 15 for the following academic year. Acceptance to graduate study does not guarantee financial assistance.

Secondary Education Courses

533 (d335). Laboratory Practicum for Secondary Science Teachers. Preservice and inservice science teachers are involved in the design, practice, and performance of science teaching demonstrations and investigative laboratory activities appropriate for secondary school science. May be repeated for credit once. (3)

536. Practicum in Improving School System Programs. A seminar focused upon a phase of the instruction program, upon a sequence of developmental training programs, upon new and persisting problems in the many dimensions of teaching. Not applicable for credit in degree programs. (1-6)

590. Independent Study. (1-3)

600 (d500). Managing Student Behavior. Theory and application of basic principles for responsible student behavior in school. (3)

604. Measurement and Evaluation in Education. Principles and techniques for developing, validating, and interpreting tests of student achievement of learning goals. (3)

610. Remedial and Developmental Reading in Secondary Schools. A course identifying principles and practices of reading diagnosis, program organization, materials development, and skill teaching at all levels; includes insights from reading research. (3)

621. Reading at the Middle/Secondary School Level. Introduces students to issues and school practices that influence student acquisition of high-level literacy skills. (3)

614. Basic Processes of Reading. Examines research and theory related to the psychological processes that occur in the comprehension and production of written language; explores implications for improving literacy instruction. (36hu)

615. Foundations of Curriculum Development. Examination of theories and principles underlying curriculum development with emphasis upon program planning and current educational trends. (3)

619. Theories of Teaching in Public Schools. Many methods and models of teaching are demonstrated, analyzed, and evaluated. Students acquire practical skill in at least four different models of teaching. (3)

620. Middle School-Junior High Curriculum. New developments in curriculum design for schools incorporating the conventional fifth, sixth, seventh, and eighth years of the public school system: functions, organization, and curriculum. (3)

624. Current Problems in Secondary Education. Studies of current problems, politics, and issues in secondary schools for teachers and supervisors. (3)

630. English Curriculum and Instruction. Evaluation of significant changes in content and methods as revealed by research and successful practice. Curriculum projects developed to meet individual needs. (3)

632. Workshop in English Curriculum. Workshop designed to investigate significant changes in content and methods for teaching the language arts-English curriculum. (3)

633. Supervision and Administration Internship. Provides experience in supervision and administration in school systems. (3)

635. Social Studies Curriculum and Instruction. Examination and critiquing of newer concepts in curriculum and methods of instruction in social studies. (3)

638 (F538). Values Education. Designed for teachers, administrators, parents, and community leaders. Examines the developmental processes of socialization and moral development; four separate approaches to values education are evaluated. (3)

640. Science Curriculum and Instruction. An examination of professional practices in science curriculum and instruction related to recent research and theory; emphasis upon science program improvement. (3)

644. Creative Education. Exploration of research concerning creativity in education relating to teaching processes and attitudes for utilizing basic principles in the improvement of classroom practices. (See El Ed 644.) (3)

645. Mathematics Curriculum and Instruction. Examination of newer concepts in curriculums and methods of instruction in mathematics in the secondary school. (3)

646. Education of the Gifted and Talented. Designed to provide educators with background and skill in working with gifted and talented students. Examines multiple types of learning and thinking talents and gifts. (See El Ed 646.) (3)

647. Identification and Evaluation in Gifted Education. Designed to provide educators with background and techniques for identifying gifted,
Department of Sociology, Social Work and Anthropology

College of Humanities, Arts and Social Sciences

Head: Associate Professor Carol J. Loveland, physical anthropology
Office in Main 216B, 797-1230

Assistant Head: Professor Richard S. Krannich, environmental, community and rural sociology, research methods

Graduate Program Coordinator: Professor Gary H. Kiger, social psychology, family, research methods

Professors Richley H. Crapo, culture, personality, linguistics; H. Reed Geertsen, community, sociological theory, medical; David F. Lancey, educational anthropology, ethnography; Ann Leffler, social psychology, theory, rural, family, gender; Ronald L. Little, environmental sociology, rural; Jon R. Moris, applied anthropology, rural development, contemporary Africa; Bradley W. Parlin, comparative sociology of work; Brian L. Pitcher, social psychology, social statistics, demography; Pamela J. Riley, social psychology, international development, criminology, gender; David L. Rogers, complex organizations, political sociology, communities; William F. Stinner, social demography, life course, community; Michael B. Toney, demography, ecology; Professors Emeriti Wade H. Andrews, social organization, natural resources, ecology; Therel R. Black, theory, rural sociology; H. Bruce Bylund, social change, methods; William A. DeHart, social psychology, gerontology; Gordon N. Keller, comparative kinship, applied anthropology; Wesley T. Maughan, community organization, sociology of education; Alison C. Thorne, marriage and family; Associate Professors E. Helen Berry, demography, ecology, methods, urban; Susan E. Dawson, social policy, program development; Gary E. Madsen, environmental sociology, social stratification; Derek T. Mason, juvenile delinquency; Steven R. Simms, archaeology, anthropological theory, behavioral ecology; Assistant Professors M. Diane Calloway, women's development, women's clinical and societal issues, social work theory; Bonnie Glass-Coffin, anthropology, shamanism; Terry Peak, social policy, health care, gerontology; Audrey M. Shillington, mental health, substance abuse; Research Assistant Professor William B. Fawcett, archaeology

1Parenthetical numbers preceded by an indicate a dual listing; parenthesis preceded by an f are the former course numbers.

© Repeatable for credit. Check with major department for limitations on number of credits that can be counted for graduation.

648. Materials and Methods in Gifted Education. Explores curriculum theories and techniques in gifted and talented education with special attention to the development of instructional materials for use with students. (See Ed Ed 648.) (3)

649. Supervised Practicum in Gifted Education. A practicum experience designed to bring students into contact with a variety of education situations that will prepare them for their anticipated professional role in gifted and talented education. May be completed in public schools, or at the Edith Bowen Laboratory School, or at the State Office of Education. (3-6)

656. Practicum in Improvement of Instruction. Designed for experienced teachers and administrators. Emphasis on improving educational programs in a specific school or district. Topics vary. (1-5)

670. Cross-Cultural Education and International Understanding. Emphasis on enhancing perspectives of the world and its peoples for teachers and on methods of including these perspectives in their subsequent teaching. (3)

671. Multicultural Education. Examines the social and cultural conditions that influence education. Places emphasis on program development to meet needs of culturally diverse school population. (3)

680. Independent Study. Individually directed study and projects. Departmental permission required before registration. (1-3, F, W, Sp, Su) ©


696. Master's Project. The student designs and carries out a creative project which is closely related to his or her area of teaching specialization. (3-9, F, W, Sp, Su)


699. Continuing Graduate Advisement. (1-12) ©

705. Internship in Program Evaluation. Experience in practical aspects of program evaluation through planned, supervised evaluation project participation approved by the student's supervisory committee. (1-6, F, W, Sp, Su) ©

706. Internship in Research. Experience in conducting research through planned, supervised research project participation approved by the student's supervisory committee. (1-6, F, W, Sp, Su) ©

712. Student Teaching Supervision. Considers ways and means of providing desirable experiences for student teachers in the public schools. Roles of cooperating teachers and university supervisors are analyzed. (3)

733. Supervision Internship. Directed activity in supervision with selected public school personnel. (3-12)

735. Internship in Curriculum Development. Directed activity in curriculum development with selected public school personnel. (3)

781. Research Seminar. Identification of research problem, consideration of research strategies and methods, application of research and statistical concepts in departmental focus, and interaction with faculty. (1) ©

790. Independent Study. Individually directed study and projects. Departmental permission required before registration. (1-3, F, W, Sp, Su) ©


799. Continuing Graduate Advisement. (1-12) ©
Degrees offered: Master of Science (MS), Master of Arts (MA), and Doctor of Philosophy (PhD) in Sociology; participates in Master of Social Sciences (MSS)

Specializations: Demography, Environmental Sociology/Natural Resources, Social Problems, Sociology of Development

Admission Requirements

See general admission requirements, pages 25-26. Students must have scores on the verbal and quantitative portions of the Graduate Record Examination (GRE) at or above the 40th percentile. TOEFL scores are required for candidates from abroad with a minimum of 550 deemed acceptable. International students with a prior degree from an English-speaking university are exempted from the TOEFL exam. Students admitted with a TOEFL score of less than 550 will be required to take the Intensive English Placement Examination upon arrival. Performance on that examination will determine the amount of Intensive English the student will need. For consideration for admission to the MSS degree program, applicants may submit either GRE or Miller Analogies Test scores.

Applications are screened throughout the year by the Graduate Program Executive Committee. No applications will be considered until all required information arrives in the School of Graduate Studies or a formal petition is made and approved.

Students with or without an undergraduate degree in sociology may enter the master’s degree program. However, before matriculating, basic competencies in sociology that have not been acquired through prior courses or experience must be developed by completing prerequisite undergraduate courses without graduate program credit. Students entering the doctoral program must complete master’s level prerequisites in sociological theory and research methods and statistics.

PhD in Sociology

In addition to coursework in sociological theory and methods, students are expected to concentrate in two of the following specialty areas. Specialty areas are distinct but are also highly integrative. One line of integration involves the department’s continuing emphasis on Rural Sociology, which links elements of all four specialty areas. The program is sufficiently flexible to permit students with a strong interest in an area other than the established specialty areas to elect that area as their second specialty area with approval of the supervisory committee and the department head or his or her delegated representative. In this case the student would select a series of courses in that area in consultation with his or her supervisory committee and the department head or his or her delegated representative.

Demography. The demography area of specialization is administered through the Population Research Laboratory. The orientation is twofold: (1) basic and policy-oriented research on sociological aspects of demographic structure and processes including migration, marriage and fertility, morbidity and mortality; and technical demographic topics such as population estimates and projections; and (2) the provision of demographic training to domestic and international students relevant to their respective settings. Research endeavors encompass a broad range of local, regional, national, and international projects in the areas of migration and population redistribution, family demography, life course and aging, health and disability, labor force, and population estimates and projections. Graduate coursework is provided in social demography, population theories and policy, demographic methods, as well as through various special topic seminars.

Social Problems. The social problems area is a specialization focused on theoretical and research-related issues relevant to a range of topics currently defined as “social problems.” Students will find a good deal of flexibility in the program, allowing them to pursue special interests. The area faculty members are actively involved in social problems research.

A number of themes are emphasized in each of the specific content courses for the social problems area. For example: How are social problems defined? What identifiable interest groups are involved in defining social problems? How do responses to social problems vary across time, place, and group? Examples of specific content courses this area may include are criminal justice, aging, gender, race and ethnic relations, mental health, sexuality, social change, stratification, science and technology, medicine, and work.

Environmental Sociology/Sociology of Natural Resources. The faculty in this area maintain an active research involvement in a wide variety of areas such as energy development, boom towns, land use planning, public participation in environmental planning, power plant siting, recreation, risk assessment, and natural resource policy and management. Staff members have been engaged in cooperative research ventures with engineering, natural resource sciences, and other physical and social sciences. Graduate curricula offerings are focused on the sociology of natural resources, human ecology, and social impact assessment.

Sociology of Development. This specialization is focused on both domestic and international issues. Two major goals of the program are to give students the conceptual and analytic foundations to understand development and to convey specific skills required for effective performance in applied fields. The basic curriculum includes courses on a broad range of topics related to processes of local, national, and international development: rural sociology, community theory and research, gender, applied anthropology, and economic development.

Core Courses. The core courses for the PhD degree in Sociology include Soc 603, 701, 702, 710, and either Soc 618 or 711.

MS and MA in Sociology

The main objective of this degree program is to provide a firm foundation in sociological theory and methods. Students also have the opportunity to take electives in any of the departmental specialty areas or outside the department.
Core Courses. The core courses for this degree include Soc 601, 602, 610, 615, and 617. The ability to utilize a statistical package (or permission of instructor) is a prerequisite to Soc 615. Such competence may be gained by taking Stat 491 (SPSS Shortcourse, 1 credit); or Stat 492 (SAS Shortcourse, 1 credit); or FHD 662 (Using and Interpreting SPSS to Analyze Social Research Data, 3 credits). As already noted, students supplement the above coursework with 15-18 credits of electives in other areas pertinent to their interests. A thesis is required.

MSS in Sociology

This degree enables interdisciplinary training in three related disciplines. The program requires a minimum of 48 credits, including: 24 credits in a major discipline (Sociology); and either (1) a minimum of 12 credits in each of two minors or (2) a minimum of 12 credits in a minor and a minimum of 12 credits in a cluster. Three credits for the Plan B paper are included in the minimum 24 credits in Sociology. An overall GPA of 3.0 is required. This is an applied degree. Individual options and plans of study can be arranged in consultation with the student’s supervisory committee.

International Rural and Community Development. This degree program is designed to prepare administrators, planners, and researchers for work in international settings. The emphasis is on social and community factors in development. The interdisciplinary curriculum in sociology of development, rural sociology, economic anthropology, political science, and the economics of development has been specifically designed to prepare practitioners and leaders for careers in applied social development. The coursework can be adapted to the individual career interest of each student. The program involves students both from abroad and from the United States.

Core Courses. Individualized programs of study are prepared with the cooperation of the student and Supervisory Committee.

Research

The graduate program’s research agenda is focused within the framework of the department’s specialty areas. Since the areas are integrative, research tends to be collaborative. Research is conducted at various levels including international, national, regional, and state. The department houses two active research units, the Institute for Social Science Research on Natural Resources and the Population Research Laboratory. Faculty play key roles on several interdisciplinary research units including the Institute for Rural and Community Development and the Women and Gender Research Institute. Graduate program faculty are frequently involved in the research activities of other research units on campus including the Center for Persons with Disabilities, the Utah Water Research Laboratory, the Mountain West Center for Regional Studies, and the International Irrigation Center.

Financial Assistance

Both departmental support and formal grant support are available to graduate students and are awarded on a competitive basis. Some highly qualified departmental graduate students are also nominated to compete for University fellowships. Students who wish to be considered for financial aid must submit applications by February 1 for the coming academic year. Financial aid forms are available from the Department of Sociology, Social Work and Anthropology. Late applications are only considered if additional funds are still available.

A variety of teaching assistantships are available through the department. Research assistantships are available through faculty members who have ongoing projects with the Utah Agricultural Experiment Station or who have research grants from the University, private companies, and federal or state agencies.

Career Opportunities

Traditionally, persons with advanced degrees in sociology have been employed in college and university settings. Recent evidence has shown a greater variety of career paths. A survey conducted by the American Sociological Association showed that 21 percent of sociologists holding the doctoral degree were employed in the private sector; 31 percent were working in the nonprofit sector; 46 percent were working in either federal, state, or local government agencies; and 12 percent were self-employed. USU sociology graduates have followed this pattern of diversity. They have secured appointments in a variety of academic, governmental, and private settings, both domestic and abroad. A sizeable number have achieved key leadership positions and high visibility in the profession.

Sociology Courses

601. Development of Sociological Theory. Traces development of sociological theory from the middle nineteenth century onward. Includes relationships between theory and research. Prerequisite: Soc 401. (3F)

602. Advanced Sociological Theory. In-depth analysis of selected modern representatives of major theoretical traditions in sociology. Prerequisite: Soc 401. (3W)

*603. Theory Construction in Sociology. Philosophic underpinnings and problems inherent in the construction of scientific theories, developing the analytic, logical, and practical skills necessary for successful theory construction. (3Sp)

610. Advanced Methods of Social Research. Philosophical underpinnings as well as the controversial issues plaguing contemporary social scientific research; research techniques and methods currently available to social scientists. (3F)

615. Social Statistics II. Statistical procedures for sociological analysis; inferential statistics, nonparametric statistics, crosstabulation, ANOVA, correlation, regression, and introductory path analysis. Prerequisite: working knowledge of SPSS or SAS and Soc 312 or equivalent courses as approved by instructor. (4W)

617. Survey Research. Focuses on data collection-questionnaire development, interviewing, mail and telephone surveys, sampling, and analysis. (3Sp)

61. Qualitative Research Methods. Focuses on nonsurvey research techniques forming the basis of much social science research. Several participant-observer techniques, necessary for successful field research, form the core of the course. (3W)

*621. Social Demography. Analysis of the articulation between demographic and social processes. Specific treatment of major contemporary social demographic theories and research is included. (3F)

*622. Population Theories and Policies. Review and evaluation of various population theories. Survey of population-related issues and evaluation of the effectiveness of various policies. (3)

*623. Methods of Population Analysis. Use of rates, ratios, life tables, and related indices in analyzing, estimating, and projecting population in geographic areas. School, welfare, and labor force populations also considered. (3)

*624. Advanced Methods of Population Analysis. Advanced techniques in demographic research; analyses of fertility, mortality, and migration and population projections. (3)
630. The Sociology of Complex Organizations. Introduction to organizational sociology. Reviews sociological literature on organizational behavior. Emphasizes the practical application of theoretical knowledge for a better understanding of work in organizational settings. (3)

631 (F550). Comparative Sociology of Work. Uses an applied and comparative cross-cultural perspective. Examines work in pre-industrial (agricultural/pastoral), industrializing, industrialized, and post-industrial societies. (3)

640. Social Problems Perspectives. Examination of major theoretical and methodological approaches to social problems. (4W)

641. Race and Ethnicity. Examination of social-psychological and structural factors that influence race and ethnic relations, especially in contemporary U.S. society. (SW)

642. Sociology of Gender. Examination of theories and research on gender stratification, especially in the contemporary U.S. (3)

645. Special Topics in Social Problems. Seminars on various topics appropriate to contemporary social problems. Subject matter will reflect current faculty research and interests. (3F, W, Sp)

646 (d444). Sociology of Health. Examination of the social and cultural factors which influence health. Health behaviors are analyzed as consequences of a variety of diverse personal and social processes. (3Sp)

660. Theories in Human Ecology. Study and analysis of classical and contemporary theories and recent analytical research in human ecology. (3)

662. Sociology of Natural Resources. For students interested in the social organization and social systems associated with natural resources. Includes principles and a field of study of resource problems. (3)

663. Social Impact Assessment. Theoretical and methodological problems of social impact assessment. Government policy processes are increasingly mandating social impact assessments to evaluate policy. (3)

665 (d465). Developing Societies. Theories and experiences of social, political, and economic development with emphasis on the problems of developing countries. (SW)

670. Advanced Rural Sociology. Analysis of major developments in rural social thought; research and application aimed at solution of rural social problems throughout the world. (3)

671 (F571). Community Theory and Research. Sociological theories and directions of research on the community in contemporary society. (3)

673 (d473). Women in International Development. Focuses on status of women in developing countries and the role they play in the development process. (3)

680. Seminar in Sociology. Seminars in various areas of sociology: (a) theory, (b) methodology, (c) demography, (d) social organization, (e) social deviance, (f) social psychology, (g) human ecology. Prerequisite: instructor's permission. (2-4F, W, Sp)

690. Independent Readings in Sociology. Independent readings in various areas of sociology: (a) theory, (b) methodology, (c) demography, (d) social organization, (e) social deviance, (f) social psychology, (g) human ecology. Prerequisite: instructor's permission. (1-3F, W, Sp, Su)

697. Thesis Research. (1-10F, W, Sp)

699. Continuing Graduate Advisement. (1-3F, W, Sp, Su)

701. Critical Issues in Sociological Theory. An assessment of critical issues and controversies which underlie major theoretical perspectives and competing schools of thought within contemporary sociology. (3)

702. Seminar on Theorists. The works of a leading sociological theorist will be examined in both breadth and depth. The theorist to be examined will vary by instructor. (3)

710. Advanced Sociological Analysis. Course examines a series of advanced methodological and data analysis procedures for the testing and construction of social theory. (3)

711. Contemporary Issues in Sociological Research. Seminar designed to permit in-depth study of emerging issues and new innovations in the collection, analysis, and interpretation of social/behavioral data. (3)

725. Advanced Demography. To provide an opportunity for detailed studies in fertility and family planning, mortality and morbidity, migration and urbanization, the labor force and economic development, and population projections. (3)

782. Social Theories on Natural Resources and the Environment. Discussion and critique of current sociological theories and applications of theories and methodologies in the field of sociology of natural resources. (3)

789. Seminar in Sociology. Seminars in various areas of sociology: (a) theory, (b) methodology, (c) demography, (d) social organization, (e) social deviance, (f) social psychology, (g) human ecology, (h) family studies. Prerequisite: instructor's permission. (1-5F, W, Sp)

790. Independent Study. Independent readings in various areas of sociology: (a) theory, (b) methodology, (c) demography, (d) social organization, (e) social deviance, (f) social psychology, (g) human ecology, (h) family studies. Prerequisite: instructor's permission. (1-5F, W, Sp)

797. Dissertation Research. (1-10F, W, Sp)

799. Continuing Graduate Advisement. (1-3F, W, Sp)

Social Work Courses

535. Public Social Policy. Examination and evaluation of various social welfare institutions and programs attacking poverty and inequality of opportunity. (3)

587. Advanced Field Practicum. Supervised agency practicum and projects for advanced students in social work. A minimum of 150 hours of field experience in a social service agency is required. Prerequisites: instructor's permission, and SW 487, 488. Enrollment limited to social work majors. (3Sp)

588. Practicum Integrative Seminar III. Integrates field work experiences and academic knowledge. Emphasis on research in practice; public social policy; values, knowledge, and skills in social work practice; and job campaign strategies. Concurrent enrollment with SW 457 is required. Prerequisite: instructor's permission. Enrollment limited to social work majors. (2Sp)

590. Topical Issue Seminar. Advanced social science seminar, designed as a forum for advanced students from varied social science disciplines. (3-6)

595. Directed Readings in Social Work. Instructor's permission and a plan for study required. (1-5F, W, Sp, Su)

Anthropology Courses

501. Senior Seminar. A seminar emphasizing research and writing skills in selected topics in anthropology. (3)

505. Third World Economic Systems. Anthropological analysis of economic institutions and development in non-Western societies. (3F, Sp)

556. Legends, Myths, and Folktales. Substance and significance of folk prose narratives both in the past and in contemporary society. (3)

600 (d400). Anthropological Theory. The intellectual history and development of alternate theoretical perspectives in anthropology. (3F, Sp)

604 (d404). Peoples of Latin America. Survey of Latin American cultures, past and present, from an anthropological perspective. Emphasis on contemporary issues in Andean South America, Amazonia, and Mesoamerica. (3W)

607 (d407). Anthropology of Sex and Gender. A cross-cultural study of gender and sexual customs. (3F)

609 (d409). Medical Anthropology. Study of disease, medicine, and health as they relate to human biology, beliefs, and lifeway examined from prehistoric to modern times and cross-culturally. (3Sp)

611 (d411). Primate Paleontology. History and evolution of the Primate Order, with particular emphasis upon the hominids (human-like forms). (3Sp)

612 (d412). Human Osteology. Study of human skeleton, including applications to fields of archaeology, paleopathology, and forensic science. (4W)

622. Folk Narrative. Principal genres of folk narrative (Marchen, tales, legends, folk histories, ballads, etc.) and the theoretical issues associated with their study. (3F, W, Sp, Su)
Department of  
**Special Education and Rehabilitation**  
College of Education

**Head:** Professor Charles L. Salzberg, applied behavioral analysis, single-subject research design, research on teacher training, employment preparation for persons with disabilities, video-disc-assisted training programs, and paraeducator training  
Office in Emma Eccles Jones Education 313A, 797-3243

**Professors** Martin Agran, education of students with severe disabilities, transition, self-determination; Garth M. Eldredge, rehabilitation counseling; Marvin G. Piffield, evaluation of persons with emotional disturbances; Alan M. Hofmeister, technology; Glenn I. Latham, persons with mental retardation, parent training, teacher effectiveness; Sarah Rule, early intervention, mainstreaming at the elementary level, technology and teacher education, adult services; Richard P. West, behavior analysis in education, computer-based decision making, parent training, school organization and administration; Karl R. White, research and evaluation, early intervention; K. Richard Young, applied behavior analysis in education, antisocial behavior, education of students with behavioral disorders and/or severe disabilities, at-risk individuals; **Associate Professors** Pamela J. Hudson, adolescents with mild disabilities; Benjamin Lignugaris/Kraft, secondary special education, social/vocational skill training, behavioral analysis, instructional design and program development; Daniel P. Morgan, behavioral disorders; **Associate Professors Emeritus** Hyrum S. Henderson, teacher training; Devoe C. Rickert, vocational training; **Assistant Professors** Betty A. Hallenbeck, mild/moderate disabilities, behavioral disorders, behavioral analysis; Jane Pemberton, extension, special education; Timothy A. Slocum, reading, mild/moderate disabilities, behavior analysis; Julie F. Smart, rehabilitation counseling; **Clinical Instructors** Barbara J. Fiecht, preschool and infant service delivery; Joan Forsgren-White, severe disabilities; Patricia B. Willis, learning disabilities

**Degrees offered:** Master of Science (MS), Master of Education (MED), Educational Specialist (EdS), Doctor of Philosophy (PhD); the Special Education and Rehabilitation Department participates in the Interdepartmental Doctor of Education (EdD)

**Specializations:** Behavioral Disorders, Early Childhood Disabilities, Learning Disabilities, Mild/Moderate Disabilities, Rehabilitation Counseling, Severe Disabilities, Vocational/Special Education

**Admission Requirements**

See general admission requirements, pages 25-26. In addition, admission committees also consider experience, undergraduate record and curriculum, and formal recommendations. A student without an undergraduate special education background may be required to complete selected undergraduate courses prior to admission as a fully matriculated graduate student.

Admission to all graduate courses in special education is contingent upon completion of an application to the
School of Graduate Studies or completion of approved undergraduate prerequisites.

Teaching Certificates
The department prepares students for certification as teachers of students with mild/moderate disabilities, students with severe disabilities, and preschool age students with disabilities. Certification may also be obtained in vision or learning impairments through a multi-university consortium program. Certification may be obtained as part of the graduate degree program or without a graduate degree.

Master's Degree Programs
The department offers programs leading to the MS or MEd. A minimum of 54 credits, including a creative project, is required for the MEd. A minimum of 54 credits, including a thesis, is required for the MS degree, except in rehabilitation counseling. Students may choose to apply for certification after completing the required coursework but before completion of the degree program.

Rehabilitation Counseling. The Master of Science degree in Special Education with specialization in Rehabilitation Counseling is designed for persons who desire a graduate program to prepare them with the basic competencies to provide rehabilitation counseling to a broad range of individuals with disabilities in a variety of settings, such as state rehabilitation agencies, independent living centers, rehabilitation hospitals, private rehabilitation facilities and agencies, employment assistance programs, and private industry. It is a 72-hour program consistent with the requirements of the Council on Rehabilitation Education (CORE).

Educational Specialist Program
The educational specialist degree is designed for advanced graduate students seeking instruction beyond a master’s degree. Programs are planned to address specific student needs, and will involve having students enroll in both master’s and doctoral courses. Completion of the EdS program will be based on completion of required coursework, submission of a research proposal to a supervisory committee, and satisfactory defense of the research project.

Doctor of Philosophy Program
The general purpose of the PhD program is to prepare leadership personnel for positions in research, teacher training and program development, policy making, and administration.

Completion of the PhD program certifies competence in the three following areas: (1) mastery of the theoretical and applied content required for providing appropriate education for persons with disabilities (infants and toddlers, children, youth, and/or adults), (2) ability to conduct independent research with particular emphasis on those research techniques in the social sciences that are most appropriate to special education, and (3) ability to effectively teach audiences of varying sophistication and expertise and to supervise the delivery of special education services.

Doctor of Education (EdD)
The department participates in the Interdepartmental Doctor of Education (EdD) degree program. For information about areas of specialization, emphases of study, research sponsored, admission requirements, procedures to follow, and other information, see pages 35-37 of this catalog.

Special Education and Rehabilitation Courses
501. Behavioral Assessment and Data-based Decision Making. Methods of collecting performance data, using data to make decisions regarding student progress, teacher accountability, and methods of graphing and analyzing data. (3F)
502. Assessment of Persons with Disabilities. Students will learn to assess persons referred for special education services to determine eligibility and to assess their progress in special education. (2F)
503. Introduction to Transition and Vocational Education. Introduction to transition programming and vocational training for students with disabilities (mild-severe), including daily living, community survival, and career education issues. (2F)
504. Foundations of Effective Instructional Procedures. Provides prospective special education teachers with effective instructional approaches to help students achieve mastery and proficiency in learning. (3F)
505. Applied Behavior Analysis in Education. Students will learn to effectively apply principles of behavior management and instruction of children and youth. (3W)
506. Consulting with Parents and Teachers. Provides strategies for communicating with parents and teachers, as members of a multidisciplinary team, to assist parents in advocacy and other teachers in collaborative problem solving. (4SP)
507. Policies and Procedures in Special Education. Provides an understanding of federal and state laws for persons with disabilities and procedures for organizing a special education classroom and auxiliary staff. (3W)
508. Remediating Behavior Problems and Social Skills Deficits. Helps develop skills for remediating behavior problems and teaching social skills in elementary/secondary settings; emphasizes protecting rights of persons exhibiting behavior problems. (3SP)
520. Student Teaching in Special Education. (3-15F, W, SP, Sa)
532. Curriculum for Students with Mild/Moderate Disabilities. Future teachers learn to analyze, school survival skills, and content area curricula, and develop skills to teach in these areas. (4W)
540. Practicum: Direct Instruction in Reading and Language. Students teach academic skills to pupils with mild or moderate disabilities daily using direct instruction techniques. Prerequisite: permission of instructor. (1.5F, W)®
541. Practicum: Instruction in Mathematics. Students will learn to teach students with mild/moderate disabilities in mathematics so that each progresses as fast as his/her capabilities allow. Prerequisite: permission of instructor. (1.5F, W)®
542. Practicum: Eligibility Assessment. Students will conduct assessments of school-aged pupils suspected of having mild or moderate disabilities according to state guidelines. Prerequisite: permission of instructor. (2SP)
543. Practicum: Teacher Designed Instruction. Students assess, design teaching materials, and provide daily instruction to pupils with mild or moderate disabilities. Prerequisites: Sp Ed 540 and 541 and permission of instructor. (1.5F, W)
551. Curriculum for Students with Severe Disabilities. Provides students with information about commercially available curricular materials, as well as the skills necessary to plan for and design curricula for persons with severe disabilities. (3W)
554. Curriculum for Secondary Level Students with Severe Disabilities. Students will learn to evaluate, administer, and interpret var-
656. Practicum in Developing School System Programs. Seminar focused upon a different phase of the instruction program; a sequence of developmental training programs; and new and persisting problems in many dimensions of teaching. Permission of instructor required. (1-6)

557. Assistive and Adaptive Technology for Persons with Disabilities. Trains students to assess needs for augmentative/alternative communication devices; and select, program for, maintain, repair, and build adaptive devices. (3W)

558. Issues in Educating Persons with Severe Disabilities. A seminar to discuss current topics and research trends affecting persons with severe disabilities. (15p)

561. Practicum: Introduction to Instruction of Students with Severe Disabilities. A field-based class providing experience in observing and teaching students with severe disabilities. Prerequisite: permission of instructor. (1-4F,W,Sp)®

562. Practicum: Systematic Instruction of Students with Severe Disabilities. Students will administer functional assessments and design instructional programs. Prerequisite: permission of instructor. (1-4F,W,Sp)®

563. Practicum: Advanced Systematic Instruction of Students with Severe Disabilities. Students will assess, design instructional programs, and develop classroom management skills. Prerequisite: permission of instructor. (1-4F,W,Sp)®

576. Teaching Infants and Young Children with Disabilities. Provides information on interventions for children aged 0-5 with disabilities, including skill areas, environmental organizations, and the family's role in developing individual family service plans and interventions. (3F)

578. Teaching the Young Child with Disabilities in the Least Restrictive Environment. Presents techniques for working with multidisciplinary staff teams and techniques of serving preschoolers with disabilities in an array of program environments. (4W)

584. Practicum in the Least Restrictive Environment with Family Service Plans. Students will participate in a variety of environments serving preschoolers with disabilities, assist in developing individual family service plans and interventions. (3F)

586. Practicum with Infants and Families. Discussion of topics relating to service delivery for infants and their families. Experience in serving families in the home. Also includes issues relating to infant health, safety, and development. (4Sp)

590. Independent Study. Permission of instructor required. (1-3F, W,Sp,Su)®

591. Independent Research. Permission of instructor required. (1-3F, W,Sp,Su)®

601. Counseling Parents of Exceptional Children. Special problems of parents. Suitable counseling, instruction, and supportive resources. (3)

602. Design and Evaluation of Effective Instruction. Approach to curriculum in which diagnosis and instruction are welded as a unit into the regular teaching procedures. (3)

603. Clinical Practicum: Student Supervised practicum in a clinical teaching setting. Prerequisite: permission of instructor. (3-12F, W,Sp,Su)

604. Functional and Augmentative Communication Approaches and Technology. Theory and methods of symbolic and nonsymbolic communication acquisition, especially for students with dual sensory impairments. Application of instruction and systems within natural routines. (5F)

605. Issues with the Delivery of Services for Students with Dual Sensory Impairments. In-depth presentation of best practices for educational services for students with dual sensory impairments. (3F)

606. Legal Aspects of Special Education. Provides a knowledge of a wide range of legal issues concerning the provision of special education services to students with disabilities. (3)

607. Infusing Mobility and Communication for Students with Dual Sensory Impairments. Reviews methods for providing orientation and mobility training to students with dual sensory impairments. Provides methods to infuse these and communication objectives into normal age-based routine activities. (3Sp)

608. Collaboration and Management of Services for Students with Dual Sensory Impairments. Reviews methods of coordination and planning of services for students with dual sensory impairments (e.g., transition, lifestyle planning, team coordinator). Service management addressing issues of scheduling, monitoring, and training of staff and peers. (3Sp)

609. Curriculum and Environmental Variations and Management. Presents instructional and curricular strategies to promote utilization of residual vision or hearing skills. Overviews tactile cueing and movement-based approaches and discusses means to integrate within natural contexts and functional activities. Review and analysis of model delivery methods, such as Individualized Curriculum Sequencing. (3)

610. Introduction Rehabilitation Counseling. Overview of the history, philosophy, and legal basis of rehabilitation programs, the roles of the rehabilitation counselor, and the process of rehabilitation. (3F)

611. Psychosocial Aspects of Disability. The psychological and sociological aspects of severe disabilities, including the adjustment factors in living with disabilities, knowledge of community attitudes, and strategies to change those attitudes. (3W)

612. Medical Aspects of Disability, Part A. Overview of basic medical information essential to understanding the vocational limitations of clients with disabling conditions. (3F)

613. Vocational Counseling. The application of vocational development theories and provision of vocational information to individuals with disabilities within the counseling process. (3Sp)

615. Case Studies in Rehabilitation. The integration of client study data, development of rehabilitation programs, and caseload management. (3Su)

616. Medical Aspects of Disability, Part B. Overview of basic medical information essential to understanding the vocational limitations of clients with disabling conditions. (3W)

617. Rehabilitation Counseling Skill Development. Utilizes role playing of simulated interviews and rehabilitation counseling sessions to develop the basic skills necessary to function as a human service helper. (3)

618. Rehabilitation Practicum. First-hand experience with clients in a rehabilitation agency or facility under faculty supervision. (3-5F, W,Sp,Su)

619. Rehabilitation Internship. Direct provision of rehabilitation services in a community facility or agency. (6-12F, W,Sp,Su)

622. Education of Emotionally Disturbed Children. Methods and procedures for those children in regular classrooms, special classrooms, and institutions. (3)

623. Teaching Secondary-aged Students with Behavioral Disorders. Emphasis on programs for adolescents in institutions and schools. (3)

626 (d574).1 Methods and Materials for Educating the Preschool Child with Disabilities. Provides students with a knowledge of curricula and instructional strategies for teaching preschool children with disabilities. (3Sp)

627. Cultural Issues in Rehabilitation. Investigation and analysis upon the effect of cultural background in the rehabilitation counseling setting. (3)

629. Teaching Social Skills to Students with Disabilities. Current research and practices related to teaching social skills to children with disabilities. Develpops teaching procedures and skills for teaching social skills. (3)

630. Collaboration Skills for Classroom Teachers. Emphasis on the knowledge, attitudes, and skills special educators must possess to effectively collaborate with parents and professionals. (3)

631. Rehabilitation of Persons with Chronic Mental Illness. Overview of unique problems associated with rehabilitating the person with chronic mental illness, as well as the methods and models of successful rehabilitation. (3)


633. Supervision and Administration Internship. Provides experience in supervision and administration in school system. (3F, W,Sp,Su)
684. Teaching Secondary Students: Content Acquisition. Provides students with procedures and techniques for facilitating the acquisition of content by students with mild or moderate disabilities. (3W)

685. Practicum: Content Acquisition. Gives master's students experience implementing content enhancement techniques in resource classrooms and in regular education classrooms. (1-3F,2Sp)

686. Theory, Practices, and Research in Learning Disabilities. Examination of theories and associated practices in learning disabilities. Examination of research findings related to the various practices in learning disabilities. (3F,3Su)

687. DSI Field Studies I: Analysis of Service for Students with Dual Sensory Impairments. First of three field experiences for students in the DSI Program. Emphasis on team-based review and analysis of services for students with dual sensory impairments. (3F)

688. Field Studies II: Analysis of Service for Students with Dual Sensory Impairments. Practicum in integrated programs for children or youth with dual sensory impairments, within context of model classroom. Emphasis placed on interdisciplinary methods for assessment, instructional design, and planning skills. (3)

689. Field Studies III: Analysis of Service for Students with Dual Sensory Impairments. Practicum in integrated programs for children or youth with dual sensory impairments, within context of model classroom. Emphasis placed on overall management of instructional environment and services. (3)

690. Field-based Application Instruction. Practicum requiring one credit hour of supervised direct student contact. Gives master's students experience implementing instruction and evaluation systems developed in Sp Ed 602. Prerequisites: Sp Ed 602 and permission of instructor. (1)

691. Field-based Applications: Collaboration. Provides opportunities to apply collaboration skills and intervention strategies in school setting. Prerequisites: Sp Ed 630 and permission of instructor. (1-3)

692. Field-based Applications: Research Into Practice. Problem-solving forum in which students are provided a structured opportunity to engage in applied, classroom-based research. Taken concurrently with Sp Ed 670. Permission of instructor required. (1-3)

693. Interdisciplinary Workshop. (1-3)®

694. Practicum in the Evaluation of Instruction. A field-based research study contributing toward graduate degrees and supervisory certification related to the assessment of an ongoing or newly proposed program of instruction. (1-6)®

695. Practicum in the Improvement of Instruction. A field-based program focused upon characteristics of effective teaching methodologies, teaching performance, curriculum decision making, value guidelines, and the characteristics of the learner. (1-6)®

696. Learning Strategies Practicum. Covers instructional procedures for two KU IRLD learning strategies. Students will teach one strategy and assess generalization of strategy to a new setting. (2Sp)

697. Vocational Assessment for Persons with Disabilities. Addresses vocational assessment for persons with disabilities. Includes an overview of traditional vocational assessment, but will focus on contemporary methodology developed for individuals with severe disabilities. (3)

698. Job Procurement, Analysis, and Placement for Persons with Disabilities. Students will develop and procure jobs for youth and adults with disabilities. They will learn systematic models for job placement that enhance opportunities for employment success for persons with severe disabilities. (3)

699. Research into Practice. Conducting high-quality applied research in school settings by systematically evaluating performance in academic, transition, and/or social settings; emphasis on translating research into classroom practice. (3)

700. Educating Autistic Children. The basic knowledge and skills needed to teach autistic children will be discussed. The course will cover etiology, assessment procedures, intervention strategies, and learning characteristics. (3)

701. Seminar in Special Education. (1-3)®

702. Rehab Professional Seminar. Provides for the in-depth discussion of current or special topics in rehabilitation. (1-3F,3W,Sp,Sp)

703. Vocational Evaluation Principles and Systems. Introduction to vocational evaluation principles and their application in using commercially available vocational evaluation systems. Actual practice with the systems (including integrated report writing) in the rehabilitation services clinic. (3)

704. Independent Study. Permission of instructor required. (1-3)®

705. Independent Research. Prerequisite: permission of instructor. (1-3)®

706. Internship in Special Education. Professional and supervised intern experience for master's program. Permission of instructor required. (3-15)

707. Creative Project. Culminating experience of MEd program. Requires proposal approval by supervisory committee. (1-6F,3W,Sp,Sp)

708. Thesis. (1-9)®

709. Continuing Graduate Advisement. (1-12F,3W,3Sp,Sp)®

710. Internship in Program Evaluation. Experience in practical aspects of program evaluation through planned, supervised evaluation project participation approved by the student's supervisory committee. Permission of instructor required. (1-6F,3W,Sp,Sp)®

711. Internship in Research. Experience in conducting research through planned, supervised research project participation approved by the student's supervisory committee. Permission of instructor required. (1-6F,3W,Sp,Sp)®

712. Supervision Internship. Permission of instructor required. (3-12)

713. Interdisciplinary Workshop. (1-3)®

714. Evaluation of Supervisory Performance. Provides students with the basic skills and knowledge required to function in various supervisory roles in the field of special education. (1-6)®

715. Issues in Special Education. Critical analysis of special education approaches, trends, and issues for post-master's students. Empirical and theoretical information presented in context where student must defend positions. (1-6)

716. Research Seminar in Special Education. Identification of research problem, consideration of research strategies and methods, application of research and statistical concepts in departmental focus, interaction with faculty. (1-6)®

717. Special Education Personnel Preparation. Seminar for potential teacher educators to become versed in current training issues and demonstrate supervision competencies through positive changes in children taught by their supervisees. (3)

718. Independent Study. Permission of instructor required. (1-3)®

719. Independent Research. Permission of instructor required. (1-3)®

720. Internship in Special Education. Professional and supervised intern experience for doctoral programs. Permission of instructor required. (1-15)®

721. Dissertation. Variable credit for dissertation project in connection with doctoral program in Special Education. (1-15)®

722. Continuing Graduate Advisement. (1-12)®

® Repeatable for credit. Check with major department for limitations on number of credits that can be counted for graduation.

َParenthetical numbers preceded by d indicate a dual listing.
Department of
Theatre Arts
College of Humanities, Arts and Social Sciences

Head: Professor Sid G. Perkes, scene design
Office in Chase Fine Arts Center 232, 797-3046

Graduate Program Coordinator: Professor Colin B. Johnson, history and criticism

Associate Professors Nancy Hills, costume design; Lynda Linford, performance; Arthur Y. Smith, interpretation;
Assistant Professors Kevin Doyle, performance; Bruce L. Duerden, technical theatre; Dennis Hassan, scene design;
Roger Held, performance; David E. Sidwell, theatre education; Lecturer Maggi E. Moar, stage movement

Degrees offered: Master of Arts (MA) and Master of Fine Arts (MFA)

Specializations for the MFA: Advanced Technical Practice, Design (scenery, costume, lighting), Directing/Performance

Admission Requirements

See general admission requirements on pages 25-26. All students making application to the MFA program who cannot audition or interview with a member of the theatre arts faculty must submit a resume and a portfolio with renderings, designs, photographs appropriate to the specialization, and any special letters of reference not included with the formal application to the School of Graduate Studies. Students with a background in performance should submit an audio cassette tape of approximately five minutes duration with two contrasting audition pieces; a musical piece is optional. Participation in the summer Old Lyric Repertory Company (OLRC) or equivalent experience is a requirement for the degree. The OLRC produces four plays in repertory from the first week in June through the middle of August each year.

The Miller Analogies Test (MAT) may be substituted for the GRE, although the department does not recommend the MAT for foreign students.

Students who have received their undergraduate training at other institutions or in a discipline other than theatre will be expected to meet a proficiency equivalent to that of USU theatre arts graduates. This may require the student to complete a minimum 30-credit program which will not count toward the graduate degree: ThArt 105, 109, 121, 150, 205, 246, 430 or 432, and 5 credits of elective Theatre Arts courses in one area. The student may be given credit for any equivalent courses taken within seven years of the date of admission. In general, no student will be admitted to the directing program who does not hold at least a bachelor's degree in theatre from a recognized institution.

Students accepted into the program must begin in the fall quarter; the discipline of theatre and the program require that students maintain a continuous residence at the campus during the first year of study.

Master of Fine Arts

The MFA is designed for students pursuing careers in educational, semi-professional, and regional theatres or, in some cases, further doctoral-level work. It is regarded by most university and college administrations as a terminal degree for individuals with academic appointments as performance coaches, designers, and technicians. The training at USU is not intended to prepare the student to meet the examination requirements of the theatrical trade unions.

The candidate for the 92 (minimum)-credit MFA completes a Plan B program and undertakes from three to five creative projects in the appropriate specialization. Under this plan, the required project reports customarily take the form of production books, journals, or a design portfolio. Students with an MA degree in theatre from another institution will normally complete a 60 (minimum)-credit program for the MFA.

Students interested in teaching dramatic literature, theatre history, and criticism at the post-secondary level should plan on using the MA as an intermediate degree to further PhD studies. The candidate for the MA (45-credit minimum) will normally complete an original thesis, but may, with the approval of the supervisory committee, execute a Plan B option.

Core Requirement. ThArt 636, 681, 690, 692, and two advanced dramatic literature courses; two 500- or 600-level theatre arts courses; a two-quarter project (6 credits) serving as a dramaturge for a Utah State Theatre production; and up to 12 credits of ThArt 607 are required. Under special circumstances, a Plan B option is available, requiring 18 credits of special project work and 3 credits of ThArt 697, for a total minimum of 54 credits.

In addition, the standard foreign language competency of 25 credits in one language or one year (15 credits) in each of two languages is required.

Master of Arts

The MA degree is a general, nonterminal degree designed to prepare the student for doctoral work or to serve as a career upgrade for secondary-school teachers.
partment's summer Old Lyric Repertory Company in Logan, Utah, satisfies this requirement. The nature of the discipline discourages credit by extension, large amounts of transfer credit, or numerous off-campus projects.

Throughout the graduate student's program, there will be continuous participation in studio programs designed to bring all graduate students together in a practical company environment. Each student is expected to maintain a primary function in his or her area of specialization while taking on work in other areas from time to time. Directing students will enroll in studio courses, held concurrently with the intermediate and advanced acting courses, with the objective of practical study in a variety of periods and styles of performance, and may elect to complete the two-quarter dramaturgy project with a Utah State Theatre production. Each student must meet with his or her supervisory MFA committee as often as necessary to seek approval for proposed and reviewed completed creative projects.

Core Requirements. The program is completed in three phases. Although there may be considerable overlap between them, each phase is examined with a formal review before the student is permitted to advance to the next. The number of quarters given is approximate.

First and Second Quarter (Entry Phase). Fall Quarter: ThArt 680, 690, 692; Winter Quarter: ThArt 680, 681, 692.

Upon the completion of this phase, the student will (1) submit a petition to advance to the next phase (mid-March), (2) identify 2-4 projects for the next phase, and (3) nominate a supervisory MFA committee, each phase is examined with a formal review before the student is permitted to advance to the next. The number of quarters given is approximate.

Second to Seventh Quarter (Project Phase). Spring Quarter: ThArt 636, 690; three 500- or 600-level dramatic literature courses; two 500- or 600-level courses in area of specialization; a cognate curriculum of a minimum of five courses outside the department to develop a skill or increase knowledge in a field related to the specialization, subject to approval of the adviser and Graduate Study Committee (15 credits total); participation in the summer Old Lyric Repertory Company or in a recognized stock or repertory program with a letter of satisfactory performance from the company director submitted to the department (6 credits, repeatable); completion of two to four projects in the field of specialization (approximately 9-18 credits).

Upon completion of this phase, the student will (1) submit a petition to advance to the final phase, (2) submit proof that projects and the written reports for them have been completed, (3) submit a proposal and/or preliminary work for a major, culminating project: renderings, preliminary working drawings, blocking script, and so forth.

Eighth and Ninth Quarter (Culminating Phase). ThArt 692 (6 credits), 697; the student executes a culminating project; a maximum of 3 credits of thesis credit; two to four additional 500- or 600-level courses for elective credit.

Note: Whenever possible, graduate projects are proposed and executed as part of the Utah State Theatre season. The option to cancel a student project or to allow work to proceed but disqualify it as an MFA project based upon insufficient preparation or validity rests with the Graduate Study Committee, the student's supervisory committee chairperson (advisee), and the executive director of Utah State Theatre. This rule is designed to protect the integrity of the artistic program of the department.

Upon completion of this phase, the student will (1) assemble the supervisory committee for a final review (defense) of the student's graduate work and (2) file a complete copy of all Plan B reports with the department in accordance with the procedures of the School of Graduate Studies. Copyrighted material, such as published scripts used for staging, will be filed separately in the Theatre Arts Office.

Financial Assistance

The department has several full assistantships, which are generally available in the area of production, depending on needs of the theatre and the skills of applying students. Other funding is available, and many of these grants include partial or full tuition waivers. Application should be made directly to the department by February 1. Graduate students are not guaranteed financial assistance during their initial year of residence.

Theatre Arts Courses

**520. Voice Methods.** Advanced work in voice that continues the training of ThArt 109 and 209. Also an introduction to various voice methodologies. (3Sp)

521. Advanced Acting. Analysis and creating of roles with emphasis on classic characterizations, traditional acting methods and styles. Prerequisites: ThArt 221, 316, 372, or equivalencies. Repeatable for up to 8 credits. (2)

533. The Teaching of Speech Communication and Theatre Arts. Development of materials and strategies for teaching secondary school speech and theatre. Team taught by Speech and Theatre Arts faculty. Prerequisite: admission to teacher education. (4F)

534. Modern Continental Drama. (3)

539. Special Topics (Topic). Specialized pre-seminar topics in theatre history offered on occasion: the classical stage, Spanish theatre, musical theatre, variety entertainments, etc. (3F,W,Sp)

540. Modern American Drama. (3)

555. Theatre Leadership and Management. Leads students through the process of founding a theatre from concept to the creation of a business plan and operations manual. (3Sp)

584. Modern British Drama. (3)

590. Special Projects in Theatre. Directed individual research studies or creative projects related to theatre. Prerequisite: permission of instructor. (1-6)

592. Production Practicum. Specialized advanced work in technical practice in ongoing Theatre Arts Department productions. Prerequisite: permission of instructor. (1-3F,W,Sp,Su)


594. **Performance Practicum.** Specialized advanced work in performance in ongoing Theatre Arts Department productions. Prerequisite: permission of instructor. (1-3F,W,Sp,Su)

610 (d510).1 **Interpreters Theatre.** Survey of Readers Theatre including skills and techniques in cutting, building, and mounting programs using all genres of literature for the classroom. (3F,W,Sp,Su) 9

618 (d518). **Storytelling.** Techniques of traditional storytelling; collecting stories appropriate for periods in the child's and young adult's development. (3F,W,Sp,Su)

619 (d519). **Tales and Telling: Preserving an Oral Tradition.** Workshop oriented course focusing on techniques for telling, building resources, and using storytelling in the curriculum and as a means to self-discovery and personal growth. (3F,W,Sp,Su)

622 (d522). **Poetry Appreciation.** Oral reading principles and positive strategies for introducing poetry to young people. (3F,W,Sp,Su)

HASS 625. **Graduate Internship/Co-op.** Professional level of educational work experience in an internship cooperative education position for graduate students. (1-15)

630 (d530). **Oral Interpretation Workshop of Children's Literature.** Theory and practice of oral reading principles for various forms of children's literature; emphasis on choral reading, play reading, and readers theatre. (3F,W,Sp,Su)

*636 (d536). **Contemporary Theatre.** Theatre from WW II to the present day, reviewing the major movements in experimentalism in literature and production from the late 19th century. (3Sp)

650 (d550). **Period Styles, Architecture, and Decoration for the Stage.** The study of theatre structural forms, period architecture, furniture, ornamentation and motifs for stage settings, and techniques and practical experience in stage prop construction. Prerequisite: ThArt 150. (3W)

651 (d551). **Advanced Scene Design.** Advanced study in design theory and rendering techniques with emphasis on scenic design for productions in a variety of styles and physical theatre spaces. Prerequisites: ThArt 150, 450, and 650/6550. (3Sp)

652 (d552). **Costume Construction Lab.** Individualized practical laboratory experience in pattern drafting, cutting, fitting, construction, and decoration of costumes for theatre productions. (2F,W,Sp,Su) 9

670 (d570). **Repertory Theatre Production.** Rehearsal, crew, and staff assignments. Performance of four plays in repertory. Company members selected through audition and based on ability and commitment to theatre. Enrollment limited and by permission of Theatre Arts Department staff. (3-12Su) 9

680. **Seminar in Drama.** (1-5F,W,Sp,Su) 9

681 (d581). **Dramatic Theory and Criticism.** Explores the traditional works of critical theory that relate to the theatrical arts beginning with Aristotle's *Poetics*. (3W) 9

690. **Research Studies.** Prerequisite: instructor's consent. (1-5F,W,Sp,Su) 9

692. **Projects in Theatre.** (1-9F,W,Sp,Su) 9

697. **Thesis.** (1-6F,W,Sp,Su) 9

699. **Continuing Graduate Advisement.** (1-3F,W,Sp,Su) 9

*Taught 1995-96.
**Taught 1996-97.
© Repeatable for credit. Check with major department for limitations on number of credits that can be counted for graduation.
1Parenthetical numbers preceded by *d* indicate a *dual* listing.
Participating Faculty in Graduate Programs


ALBRECHTSEN, RULON S. (1969) Prof., Plants, Soils, and Biome- tology. BS 1956, MS 1957 Utah State University, PhD 1965 Purdue University.


ALLEN, STANLEY D. (1979) Prof., Animal, Dairy and Veterinary Sciences; Chairman, Committee on Experimental Animals. BS 1967 Utah State University, DVM 1971 Iowa State University.


ANDERSON, J. LAMAR (1961) Prof., Plants, Soils, and Biome- tology. BS 1955 Utah State University, PhD 1961 University of Wisconsin.


ANDERSON, LOREN RUNAR (1974) Prof. and Dept. Head, Civil and Environmental Engineering. BS 1984, PhD 1972 Utah State University, PE.

ANDERSON, LUEL A (1991) Asst. Prof., Human Environments. BS 1967 Iowa State University, MS 1973 Texas Tech University, PhD 1993 Iowa State University.

ANDRES, THEODORE (1961) Assoc. Prof. and Director of Undergraduate Studies, English. BS 1961, MA 1963 Utah State University, BA 1973 University of Oregon.

AREVI, CLIVE WENDELL (1965) Prof., Animal, Dairy and Veterinary Sciences. BS 1956, MS 1957 Utah State University, PhD 1963 University of California (Davis).


ASCIONE, FRANK R. (1973) Prof., Psychology and Center for Persons with Disabilities; Adjunct Prof., Family and Human Development. BS 1969 Georgetown University, PhD 1973 University of North Carolina.


ASPAAS, HELEN RUTH (1992) Asst. Prof., Geography and Earth Resources. BA 1972 Fort Lewis College, MA 1986 University of Nebraska (Lincoln), PhD 1982 University of Colorado (Boulder).


AUSTIN, ANN M. BERGHOUT (1980) Prof., Family and Human Development; Adjunct Prof., Psychology; Adjunct Prof., Human Environments; Asst. Dean for Academic Affairs, College of Family Life. BS 1971, MS 1977 Utah State University, PhD 1981 Iowa State University.

BAER, RICHARD D. (1976) Adjunct Asst. Prof., Psychology, Lecturer, Special Education and Rehabilitation; Director—Outreach, Center for Persons with Disabilities. BS 1968 Towson State College, MS 1978 Utah State University.

BAGLEY, CLEL L V. (1975) Prof., Animal, Dairy and Veterinary Sciences; Veterinarian, University Extension. BS 1965 Utah State University, DVM 1968 Colorado State University.

BAGLEY, JAY M. (1954) Prof., Emeritus of Utah Water Research Laboratory and Civil and Environmental Engineering. BS 1952, MS 1953 Utah State University, PhD 1964 Stanford University, PE.

BAILEY, DeeVON (1983) Prof. and Ext. Specialist, Economics. BA 1979, MA 1980 Utah State University, PhD 1983 Texas A&M University.

BAKER, DORAN J. (1969) Prof., Electrical and Computer Engineering; Adjunct Prof., History; Vice President, Utah State University Research Foundation. BS 1953, PhD 1956 University of Utah.


BAKKE, JAN (1977) Prof., English. BA 1958, MA 1961 University of Virginia, PhD 1975 University of Texas Austin.


BANNER, ROGER E. (1983) Assoc. Prof., Rangeland Resources; Range Management Specialist, University Extension. BS 1967 Texas Technological College, MS 1969 New Mexico State University, PhD 1981 Utah State University.


BARKWORTH, MARY E. (1978) University, PhD 1980 Montana State University.


BARTON, CLAIR (1963) Asst. Prof., Business Administration. BA 1963 California State University, MBA 1965 Humboldt State University, PhD 1969 Massachusetts Institute of Technology.

BARTON, CLAIR (1963) Asst. Prof., Business Administration. BA 1963 California State University, MBA 1965 Humboldt State University, PhD 1969 Massachusetts Institute of Technology.


BARTHELEMY, ALLAN (1963) Prof., Mechanical and Aerospace Engineering. BS 1961, MS 1963 Utah State University, PhD 1969 University of California (Los Angeles).

BATTY, JOSEPH CLAIR (1963) Prof., Mechanical and Aerospace Engineering. BS 1961, MS 1963 Utah State University, ScD 1969 Massachusetts Institute of Technology.


BECKER, KURT (1994) Assoc. Prof., Industrial Technology and Education. BS 1977 Southeast Missouri State University, MS 1983 Sam Houston State University, PhD 1988 Texas A&M University.


BIALEKOWSKI, STEPHEN E. (1983) Prof., Chemistry and Biochemistry; Adjunct Prof., Physics and Electrical and Computer Engineering. BS 1975 Eastern Michigan University, PhD 1975 University of Utah.

BINGHAM, GAIL ELDON (1982) Research Assoc. Prof., Plants, Soils, and Biometeorology; Adjunct Research Assoc. Prof., Geography and Earth Resources. BS 1968 Utah State University, MS 1968, PhD 1972 Cornell University.

BISHOP, A. BRUCE (1971) Prof., Civil and Environmental Engineering and Utah Water Research Laboratory; Acting Provost. BS 1965, MS 1966 Utah State University, PhD 1970 Stanford University.

BISONETTE, JOHN A. (1985) Prof., Fisheries and Wildlife; Leader, Utah Cooperative Fish and Wildlife Research Unit; Adjunct Prof., Geography and Earth Resources. BA 1964 University of Vermont, MFS 1970 Yale University, PhD 1976 University of Michigan.


BLAHNA, DALE J. (1991) Assoc. Prof., Forest Resources; Adjunct Assoc. Prof., Sociology, Social Work and Anthropology; Adjunct Assoc. Prof., Geography and Earth Resources; Adjunct Assoc. Prof., Landscape Architecture and Environmental Planning. BA 1975 University of Wisconsin (Milwaukee), MS 1976 University of Wisconsin (Stevens Point), PhD 1985 University of Michigan.

BLAIR, JAMES CARSON (1979) Prof. and Director of the Program in Education of the Deaf and Hard of Hearing, Communicative Disorders and Deaf Education. BS 1966 University of Utah, MS 1969 Utah State University, PhD 1976 Northwestern University.

BLOTER, PAUL THOMAS (1970) Prof., Mechanical and Aerospace Engineering and Systems Division, Space Dynamics Laboratory. BS 1964, MS 1966 Utah State University, PhD 1968 Michigan State University, PE.


BOETTINGER, JANIS L. (1992) Asst. Prof., Plants, Soils, and Biometeorology; Adjunct Asst. Prof., Geology. BS 1984 Cornell University, MS 1988, PhD 1992 University of California (Davis).


BOND, LARRY KEITH (1972) Assoc. Prof., Economics; Agricultural Economics Specialist, University Extension. BA 1960 Brigham Young University, MS 1962 University of Arizona, PhD 1972 Utah State University.

BOWLES, DAVID S. (1977, 1983) Prof. and Director, Utah Water Research Laboratory; Director, Utah Center for Water Resources Research; Prof., Civil and Environmental Engineering. BS 1972 City University, London, PhD 1977 Utah State University.

BOYCE, GLENNCA COOPER (1980) Research Assistant, Center for Persons with Disabilities; Adjunct Asst. Prof., Family and Human Development. BA 1960 Brigham Young University, MS 1969, PhD 1990 Utah State University.


BRENNAND, CHARLOTTE P. (1968) Assoc. Prof. and Ext. Specialist, Nutrition and Food Sciences. BS 1965 New Mexico State University, MS 1967 University of California (Davis), PhD 1989 University of Wisconsin (Madison).

BREWER, KENNETH W. (1968) Prof. and Director of Graduate Studies, English. BA 1963 Western New Mexico University, MA 1967 New Mexico State University, PhD 1973 University of Utah.

BRINDLEY, WILLIAM A. (1965) Prof. and Director of Graduate Studies, Biology; Chairman, Chemical Hygiene Committee. BS 1960, MS 1963, PhD 1966 Iowa State University.


BROWN, RODNEY J. (1979) Prof., Nutrition and Food Sciences; Dean, College of Agriculture. BS 1972 Brigham Young University, MS 1973 Utah State University, PhD 1977 North Carolina State University.


BUNCH, THOMAS DAVID (1973) Prof., Animal, Dairy and Veterinary Sciences, Fisheries and Wildlife. BS 1968, MS 1969 Brigham Young University, PhD 1971 Utah State University.

BURNHAM, BYRON ROBERT (1973) Assoc. Prof., Instructional Technology; Research Assoc. Prof., Psychology, Program Leader—Outreach Technology and Assoc. Dean—Extension, Learning Resources Program; Staff Development and Evaluation Specialist, University Extension. BS 1969, MS 1971 Utah State University, EdD 1984 University of British Columbia.

BURRELL, W. CRAIG (1978) Assoc. Prof., Animal, Dairy and Veterinary Sciences; Area Livestock Specialist, Utah County. University Extension. BS 1968 Brigham Young University, MS 1972 Colorado State University, PhD 1977 Texas A&M University.


BUTLER, ANNE M. (1989) Prof., History; Assoc. Editor, Western Historical Quarterly. BS 1973 Towson State University, MA 1975, PhD 1979 University of Maryland.


Caldwell, MArtyn m. (1967) Prof., Rangeland Resources. BS 1963 Colorado State University, PhD 1967 Duke University.

Caliendo, Joseph A. (1992) Assoc. Prof., Civil and Environmental Engineering. BS 1989 University of Detroit, BS 1974 Humboldt State University, MS 1977, PhD 1986 Utah State University, PE.


Campbell, William Frank (1968) Prof. and Asst. Dept. Head, Plants, Soils, and Biometeorology. BS 1956, MS 1957 University of Illinois, PhD 1964 Michigan State University.


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Application Procedures

Application

The application fee is $30 for U.S. citizens and $35 for international applicants. The application fee is nonrefundable. (The University reserves the right to alter the application fee without notice.)

U.S. citizen applicants should detach the Application for Admission from the Graduate Catalog, complete the form, and send the application and the application fee to the School of Graduate Studies, Utah State University, Logan, UT 84322-0900.

International applicants should not use the Application for Admission form in the catalog, but should request an international application using the International Student Information card at the back of the catalog. Also refer to the Admission Procedures section in this catalog.

Your application will be processed only when all credentials and the application fee have been received. (EXCEPTIONS ARE NOT MADE.)

Credentials

Transcripts, admission test scores, and reference letters must be sent directly from their sources to the School of Graduate Studies. Copies submitted by the student are not official. (Please note: All materials submitted as part of the application credentials become the property of the School of Graduate Studies and will not be returned to the student.)

List in Item 8 all postsecondary colleges and/or universities attended. Attach a separate page if necessary. Failure to list all postsecondary institutions attended may result in cancellation of the application or dismissal from a graduate program. Arrange with each college or university attended to send two official transcripts. Transcripts from different institutions accumulated on one record are not acceptable. The School of Graduate Studies will obtain your Utah State University transcript if you include USU as an attended university.

List three recommenders in Item 13. At least two of the recommendation letters should be from persons who are familiar with your academic abilities. A recommendation form is provided in this catalog to be photocopied for the necessary copies. Ask the recommenders to send letters promptly. The letters should be returned to the address at the top of the recommendation form. If you fail to complete Item 13, your application may be returned to you to be completed.

Official admission test results must be on file in the School of Graduate Studies before an application can be processed. Test scores must be sent to the School of Graduate Studies directly from Educational Testing Service or Psychological Corporation. See the Admission Procedures and the department sections of the Graduate Catalog for the required test(s) for the program to which you are applying.

Degree and Major Area

List the Degree and the Area of Specialization in which you wish to study. The degrees offered are listed on page 27 of the Graduate Catalog and specializations are listed in the departmental and program descriptions in the Graduate Catalog.

School of Graduate Studies

Application Deadlines

April 15 . . . . . . . summer quarter
July 15 . . . . . . . . . fall quarter
October 15 . . . . winter quarter
January 15 . . . . spring quarter

Some of the departments have deadlines that are earlier than the School of Graduate Studies deadlines. You should check with the department to which you are applying to determine if there is a different application deadline.

Financial Assistance

Applications for assistantships, fellowships, and other financial aid should be obtained through the department to which you are applying. See the Financial Assistance section of the Graduate Catalog.

Housing Information

To obtain information about on-campus single and married student housing, please use the On-Campus Housing Information card at the back of the catalog or call the appropriate telephone number.

Single Student Housing
(801) 797-3111
Married Student Housing
(801) 797-3122

See the Housing section on page 21 of the Graduate Catalog.

Additional Information

If you wish additional information about departmental programs and/or about department financial support, please use the Department Information card at the back of the catalog.
APPLICATION FOR ADMISSION

Date of Application ____________________ For School Year ______ Quarter (check one): Summer □ Fall □ Winter □ Spring □

If applying for the MBA, please indicate whether you are interested in the on-campus program or the Ogden program. __________

(Please print or use a typewriter.)

1. Name in full ___________________________ Soc. Sec. No. ___________________________
   Last (Family or Surname) ___________________________ First ___________________________ Middle ___________________________

2. Other names under which your academic records may be listed ___________________________

3. Mailing address ___________________________ Phone ___________________________
   Number and Street or RFD ___________________________ City ___________________________ State or Country ___ ZIP ___

4. Permanent address (if different) ___________________________

5. Electronic mail address ___________________________

6. State of legal residence ___________________________

7. How long have you lived in Utah? Years _______ Months _______ Continuously since _______ Month/Year

8. Place of birth ___________________________ Date of birth ___________________________ Please check one: Male □ Female □

9. Citizenship (check one): U.S. Citizen □ Immigrant □ Student Visa □ Other ___________________________

10. Ethnic background: Caucasian □ African □ Asian □ Native □ Hispanic □ International □ Other □
    American □ American □ American □ American □ American Student

11. List in chronological order all colleges and/or universities attended, including USU. (Attach separate sheet if needed.) Failure to list all institutions and colleges attended may result in cancellation of the application or dismissal from a graduate program.

<table>
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<th>Name of Institution</th>
<th>Location</th>
<th>Dates of Attendance (Month and Year)</th>
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<th>Degree</th>
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12. List undergraduate major ___________________________ Undergraduate minor ___________________________

13. In what subject do you plan to major as a graduate student? ___________________________ Major Field ___________________________ Specialization ___________________________

14. What degree do you seek? ___________________________

15. Admissions test(s) taken: GRE General □ GRE Subject □ Miller Analogies Test □ GMAT □
    Date(s) taken ___________________________ TOEFL □ (international students only) Date taken ___________________________

16. List three persons whom you will ask to mail directly to the School of Graduate Studies confidential recommendations of your qualifications to pursue graduate work. At least two should be persons from whom you have taken academic coursework.

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<tr>
<th>Name</th>
<th>Position</th>
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17. Name or parent, spouse, or legal guardian ___________________________ Relationship ___________________________

18. Address of person named above ___________________________ Street Number ___________________________ City ___________________________ State ___________________________ Country ___________________________
19. List your employment for the last five years, other than school attendance or service in the Armed Forces. (Use additional sheet if necessary.)

<table>
<thead>
<tr>
<th>Dates (Month and Year)</th>
<th>Occupation</th>
<th>Employer</th>
<th>City and State or Country</th>
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20. Write a statement of your specific reasons for wanting to attend graduate school. Describe your experience and qualifications for advanced study. (Use additional sheet if necessary.)

Signature of applicant ____________________________ Date _________________

Utah State University is committed to providing equal educational and employment opportunity regardless of race, sex, color, religion, national origin, marital or parental status, physical or mental disability, or age.

This form can be made available in braille, large print, and audio format upon request.

DO NOT WRITE IN THIS SPACE--FOR OFFICE USE ONLY.

Application evaluation fee received ____________________________ Date _________________

Class rank ____________________________ Approval ____________________________
Please type or print.

Name of Applicant ____________________________

(Last or Family Name) (First) (Middle)

Department or program __________________________ Area of specialization __________________________

At least one recommendation must be submitted from the last school attended for full-time study, unless the applicant has been out of school five years or longer.

I do □ I do not □ waive my right to inspect the contents of the following recommendation.

Signature: ____________________________

(Applicant)

RECOMMENDER'S COMMENTS

How well do you know the applicant ____________________________

What is your estimate of the applicant's promise as a graduate student? Please discuss the applicant's accomplishments, intellectual independence, capacity for analytical thinking, ability to organize and express ideas clearly, motivation, potential for teaching, and any previous writing experiences that would be relevant.

If applicant's native language is not English, please evaluate his/her English proficiency ____________________________

On the following scale please rank applicant against other students in comparable fields.

<table>
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<th>Bottom Quarter</th>
<th>Third Quarter</th>
<th>Second Quarter</th>
<th>Top 25%</th>
<th>Top 10%</th>
<th>Top 5%</th>
<th>Top 1-2%</th>
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</table>

Admission to the School of Graduate Studies at Utah State University is:

□ Strongly recommended
□ Recommended
□ Recommended with reservations
□ NOT recommended

Signature ____________________________

Name ____________________________

Title ____________________________

Institution ____________________________

Address ____________________________

Date ____________________________
INTERNATIONAL STUDENT INFORMATION
Utah State University
School of Graduate Studies
Logan, UT 84322-0900
USA

Name ________________________________________________
Address ________________________________________________
City, State, Country ___________________________ Zip Code ______
Undergraduate Major ___________________________ Degree ______
School ___________________________ Graduation Year ______
I am interested in attending Utah State University as a graduate student. I am a
permanent resident of ___________________________ (name of country)
Visa Type ___________________________

☐ Please send the International Student Application for Admission.
(Use the Major Department Information request card below to receive information
about your field of study.)

MAJOR DEPARTMENT INFORMATION
Utah State University
School of Graduate Studies
Logan, UT 84322-0900
USA

Name ________________________________________________
Address ________________________________________________
City, State, Country ___________________________ Zip Code ______
Undergraduate Major ___________________________ Degree ______
School ___________________________ Graduation Year ______

☐ Please send information on the graduate degree program
in ___________________________ (name of major/area)

☐ Please send an application and information about departmental financial support.
I am interested in pursuing a ☐ master's degree. ☐ doctoral degree.
I have filed an Application for Admission to Graduate School. Yes ____ No ____. If yes,
date of filing ___________________________

International students: I have already requested an International Student Application
for Admission. Yes ____ No ____

ON-CAMPUS HOUSING INFORMATION
Utah State University
Housing Office
Logan, UT 84322-8600

Name ________________________________________________
Address ________________________________________________
City, State/Country ___________________________ Zip Code ______

Please send information and an application for on-campus housing for:

☐ Graduate students with families (spouse and/or children)
☐ Graduate students (single)