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Graduate College
2012-13 Graduate Catalog

First Edition
published July 2012

Graduate
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2012-13
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College of Natural and Applied Sciences

Dean: Tamera S. Jahnke

Associate Deans: Xingping Sun and Daniel Beckman

Office: Temple Hall, Room 142

Phone: (417) 836-5249, Fax: (417) 836-6934

Academic Units

- [Master of Natural and Applied Science \(Interdisciplinary Program\)](#)
- [Department of Biology](#)
- [Department of Chemistry](#)
- [Department of Computer Science](#)
- [Department of Geography, Geology, and Planning](#)
- [Department of Hospitality and Restaurant Administration](#)
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Interdisciplinary Programs

Master of Natural and Applied Sciences (includes accelerated master's opportunity)

Xingping Sun, Graduate Director

Department of Biology

S. Alicia Mathis, Department Head

D. Alexander Wait, Graduate Director

Master of Science, Biology (includes accelerated masters opportunity)

Master of Science in Education, Secondary Education

Department of Chemistry

G. Alan Schick, Department Head

Erich Steinle, Graduate Director

Master of Science, Chemistry (includes accelerated master's opportunity)

Master of Science in Education, Secondary Education

Department of Computer Science

Kenneth R. Vollmar, Department Head

Department of Geography, Geology and Planning

Thomas G. Plymate, Department Head

Robert T. Pavlowsky, Graduate Director

Master of Science, Geospatial Sciences in Geography and Geology (includes accelerated master's opportunity)

Master of Science in Administrative Studies, Environmental Management Option

Master of Science in Education, Secondary Education

Graduate Certificate: Geospatial Information Science (offered jointly with the Missouri University of Science and Technology (MS&T))

Department of Hospitality and Restaurant Administration

Melissa Dallas, Department Head

Department of Mathematics

William Bray, Department Head

Master of Science, Mathematics (includes accelerated master's opportunity)

Master of Science in Education, Secondary Education (includes accelerated master's opportunity)

Department of Physics, Astronomy and Materials Science

David M. Cornelison, Department Head

Kartik Ghosh, Graduate Director

Master of Science, Materials Science (includes accelerated master's opportunity)

Master of Science in Education, Secondary Education

Science Education Courses

(Courses may be used in various programs in the College of Natural and Applied Sciences)

SCI 605 Intellectual Foundations of Science and Technology. 3(3-0), S. An historical and philosophical examination of the origins and the development of science and technology. The differences between science and technology, their interrelationships in modern times, and the impact of each of these on society will be considered. May be taught concurrently with SCI 505. Cannot receive credit for both SCI 505 and SCI 605.

SCI 685 Topics in Science Education. 1-4 D. A variable content course for offering selected topics of interest to science teachers in the elementary, middle, or secondary schools; or in college classrooms. May be repeated up to 6 hours when the topic varies. No more than 6 hours may be counted toward a degree. May be taught concurrently with SCI 580. Cannot receive credit for both SCI 685 and SCI 580.

SCI 780 Advanced Topics in Science Education. 1-4, D. Prerequisite: 12 hours of graduate coursework. A variable content course for offering selected topics of interest to science teachers in the elementary, middle, or secondary schools; or in college

classrooms. May be repeated up to 6 hours when the topic varies. Maximum of 6 hours may be counted toward degree.

Master of Science, Administrative Studies: Environmental Management Option

Program Description

Several departments in the College of Natural and Applied Science participate in the Master of Science, Administrative Studies (MSAS) degree by contributing courses in the Environmental Management Option. The MSAS is an interdisciplinary program composed of courses from departments and colleges across campus. The program, which includes a significant online component, is administered by a faculty committee and housed in the Graduate College. For more information, see the full MSAS program listing in the Graduate College section of this catalog.



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Master of Natural and Applied Science (Interdisciplinary Program)

Temple Hall, room 142, Phone: (417) 836-5249

Email: XingpingSun@MissouriState.edu

Website: <http://www.cnas.missouristate.edu/mnas.htm>

Director: Xingping Sun

Program Description

The Master of Natural and Applied Science is designed to provide those working in an environment where scientific knowledge is a priority, such as science teaching and scientific applications, the opportunity to expand their knowledge and experiences consistent with their professional goals and objectives through an interdisciplinary program of study in the natural and applied sciences. The curriculum will consist of formal courses in one or more areas of concentration, professional advisement, graduate seminar or research options (e.g., master's thesis), as well as incorporating the candidate's background, goals, and objectives.

Program Objectives

1. To increase both the depth and breadth of knowledge in one or more of the areas in natural sciences for understanding and appreciation of the interdisciplinary nature of science.
2. To provide advanced training and education for expanding current scientific knowledge and capabilities.
3. To provide a base of knowledge or enhancement in an area of natural science outside an original field of study.

Admission Requirements

Students admitted in full standing must meet the following requirements.

1. The student must have a bachelor's degree from a college or university accredited by agencies recognized by Missouri State University or equivalent education from a foreign university.
2. The student must have a GPA of 3.00 on a 4.00 scale for the last 60 hours of course work, AND, a score on the Graduate Record Examination (GRE) meeting or surpassing the minimum score prescribed by the MSU Graduate Catalog for admission to graduate study.
3. Submission of a Letter of Interest and at least two Letters of Recommendation.
4. International applicants are also required to submit a score of not less than 550 on the paper-based or a comparable score of 213

on the computer-based TOEFL, with a minimum of 50th percentile on the Listening Comprehension Section.

5. The student must have an undergraduate background of at least 20 semester hours in the natural and applied sciences.

Degree Requirements (minimum of 32 hours)

1. **Advisory Committee.** Initially, each student will be advised by the departmental coordinator of graduate studies from the student's primary emphasis area. As soon as possible, the student will select a graduate faculty member from that department to chair a graduate advisory committee consisting of at least three faculty members that includes a faculty member from the student's second area of concentration. This committee will supervise the remainder of the student's program.
2. **Program of Study.** This unique interdisciplinary masters program requires more than one area of concentration. Each individualized program will be structured by the advisory committee in consultation with the student. The academic background, professional experience, academic objectives, and personal needs will be considered in establishing the individual's program.

Students may select areas of primary emphasis in the following six departments in the College of Natural and Applied Sciences: Biology; Chemistry; Computer Science; Geography, Geology and Planning; Mathematics; and Physics, Astronomy and Material Science; and in the Darr School of Agriculture. In special cases, a "primary emphasis" may be a science topic that is interdisciplinary in itself (for example, Environmental Science), and the relevant course work include more than one department; such a program of study must be approved by the student's Advisory Committee and program director. Students will select a second area of concentration in the following departments: Biology; Chemistry; Computer Science; Geography, Geology and Planning; Mathematics; and Physics, Astronomy and Material Science. With approval of the Advisory Committee and program director, other possible outside areas may be pursued, such as education or business. This second area of concentration may also be inherently interdisciplinary as long as it is distinct from the primary area.

3. **Course Requirements.** The student must select a primary emphasis area consisting of at least 16 hours of courses selected from one department in the College of Natural and Applied Sciences listed above. The student must also select 9-16 hours of graduate courses outside the primary area approved by the student's advisory committee. In total, the student must complete at least 32 hours of course work, of which at least 16 must be in courses open only to graduate students (numbered 700 or above).
4. **Grade Point Average.** A GPA of at least 3.00 on a 4.00 scale for all graduate work at Missouri State and course work transferred from other institutions is required.
5. **Research Requirements.** A student will be required to complete one of the following research requirements.

Thesis Option: The Thesis option requires the completion of a research thesis supervised by the student's advisory committee. The thesis shall be approved by the advisory committee and by the Dean of the Graduate College before the degree is granted. A maximum of six hours of thesis credit can be applied toward the minimum hours required for the master's degree.

Non-Thesis Option: The Non-Thesis option requires the completion of a minimum of one semester course which shall require an extensive research paper or creative work. The student's advisory committee must approve the final research paper and complete a Seminar Report form that is submitted to the academic department chosen as the major area of concentration and subsequently to the Graduate College for the approval of the Dean.

Internship Option: The Internship option requires the completion of internship with a discipline-related business, non-profit organization, or government agency (480 hours). This must include an extensive project that is approved and supervised by the student's on-site mentor and the departmental advisory committee. A maximum of six hours of Internship credit can be applied toward the 32 hours required for this degree.

6. **Comprehensive Examination.** After the course work has been completed, and upon approval of the advisory committee, a written comprehensive examination will be administered and evaluated by the advisory committee. This examination must be passed by the candidate before a degree will be given.
7. **Time Limit.** The student must complete all requirements within an eight-year period (exclusive of the time spent in the United States Armed Forces).

Accelerated Master's Degree Option

Eligible Missouri State University students in a major in the College of Natural and Applied Sciences may apply for preliminary acceptance into the Master of Natural and Applied Science program after admission requirements for the accelerated master's option have been satisfied. If accepted, graduate courses chosen from approved 600-level courses or higher may be counted toward both the graduate and undergraduate degrees, with a maximum of 12 credit hours. This option offers an opportunity for CNAS majors whose goals, academic capabilities, and career planning include graduate work, to complete the requirements for the master's degree in less time than would otherwise be possible. Contact the MNAS Program Director for further information and guidelines.

All requirements for the implemented undergraduate program should be met for graduation from the undergraduate degree program. A student may fully be admitted to the Graduate College upon completion of the requirements for the baccalaureate degree. All requirements for the implemented master's program should be met for graduation from the master's degree program.

A student must be admitted into the Accelerated Master's Degree Program at Missouri State University in order to begin taking graduate course work for dual credit. Admission requires approval from the Graduate Program Advisor, Department Head of the undergraduate program, and the Dean of the Graduate College. Students admitted into the Accelerated Master's Degree program will not be fully admitted into the Graduate College until completion of their undergraduate degree and fulfillment of all other requirements for admission to the Graduate College (such as the Graduate Record Examination). Student should be awarded the bachelors degree upon completion of the minimum of 125 hours of combined graduate and undergraduate course work and degree specific requirements.

Admission Requirements for the Accelerated Master's Option

1. Junior standing and a GPA 3.25 or better.
2. A GRE score of at least 1000 on the verbal plus quantitative section.
3. A supportive recommendation from the student's undergraduate advisor.
4. Acceptance of applicant by a graduate faculty member who agrees to serve as the student's graduate mentor.



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Department of Biology

Temple Hall, Room 212, Phone: (417) 836-5126, Fax: (417) 836-4204

Email: biology@missouristate.edu

Website: <http://biology.missouristate.edu>

Department Head: S. Alicia Mathis

Faculty

Professor: M. Christopher Barnhart, Daniel W. Beckman, Paul L. Durham, Frank A. Einhellig, Janice S. Greene, John E. Havel, John S. Heywood, Laszlo G. Kovacs, S. Alicia Mathis, Thomas E. Tomasi, D. Alexander Wait

Associate Professor: Brian D. Greene, Kyoungtae Kim, Georgianna Saunders

Assistant Professor: Day Ligon, Brian Weaver

Adjunct Faculty: Wendy B. Anderson, David E. Bowles, Sami Khoshyomn, Lloyd W. Morrison, J. Daren Reidle, Gareth A. Rowell

Emeritus Professor: Jerry D. Berlin, Loren L. Denney, Roar L. Irgens, Steven L. Jensen, Don L. Moll, Richard L. Myers, Grant L. Pyrah, Paul L. Redfearn, Russell G. Rhodes, Lynn W. Robbins, John G. Steiert, Robert F. Wilkinson, Jr.

Programs

Master of Science, Biology

D. Alexander Wait, Graduate Director

Temple Hall, Room 248; Phone (417) 836-5802

AlexanderWait@missouristate.edu

Program Description

The Department of Biology offers a Master of Science in Biology, participates in the Master of Natural and Applied Science (MNAS) and the Master of Science in Plant Science, and in conjunction with the College of Education, the Master of Science in Education with emphases in biology and natural science. Together with an advisor, students design an individual program of study, selecting courses that provide additional background in biology as well as developing an area of concentration.

Areas of research include animal behavior, aquatic biology, cellular biology, ecology, field biology, immunology, microbiology, physiology, systematics, and wildlife conservation. During the first semester, the student declares an area of specialization and begins

to pursue a research problem (thesis) with the close supervision of a graduate faculty thesis committee.

Most course work is usually completed by the end of the second or third semester, and the thesis or non-thesis option is completed after four or five semesters. A comprehensive examination is taken during the second year. A maximum of 9 hours of approved graduate courses taken in related subjects outside the Biology department may be counted.

This graduate program has been designed to provide opportunities for continued study and mastery of new skills for those who desire to maintain or increase their competence in biology and its allied environmental and health-related fields. Some students completing the program have continued their education in doctoral programs, while others have accepted positions as ecologists, conservationists, industrial laboratory supervisors, research assistants, or teachers in secondary schools or colleges.

Graduate Assistantships

Evaluation of applications for teaching assistantships begins on March 1 (fall assistantships) and October 1 (spring assistantships), and will continue until positions are filled. Applicants must first be accepted into the program, and files must be complete to be considered. Therefore, applicants should apply by February 1/Sept 1 to ensure being considered for a TA position.

Retention Requirements

To remain in the program, a student must maintain a GPA of 3.00 and make satisfactory progress on the research project.

Admission Requirements for the Accelerated Master's Option

1. Junior standing, a GPA in biology of 3.25 or better and an overall GPA of 3.25 or better.
2. Completion of BIO 121, 122, 235, 369, 310 or 320 or 361; CHM 200 or 310; MTH 138 or 135 and 181 with an overall GPA of 3.25 or better.
3. Undergraduate laboratory or field research experience in residence in the Department of Biology with a supportive recommendation from the student's undergraduate research advisor. [Note: undergraduate research experience at another university conducted in collaboration with Missouri State University Biology faculty may be considered.]
4. GRE scores commensurate with the advanced standing of this option.
5. Acceptance of applicant by a graduate faculty member who agrees to serve as the student's graduate research advisor.
6. Acceptance of the applicant by the graduate faculty in Biology under the accelerated masters option.

Accelerated Master's Degree Option

Eligible Missouri State University majors in biology may apply for preliminary acceptance into the Master of Science program in Biology after admission requirements for the accelerated masters option have been satisfied. {Note: biology majors at other universities approved for participation in this program may apply if they meet the requirements below.} If accepted, graduate courses chosen from approved 600 or 700-level courses may be counted toward both the graduate and undergraduate degrees, with a maximum of 12 credit hours counted. This option offers an opportunity for biology majors with undergraduate laboratory research experience to complete the course requirements for the Master of Science degree in Biology in two semesters and a summer after attaining the Bachelor's degree, rather than the typical four semesters and a summer. Contact the Department of Biology for further information and guidelines.

Before enrolling in a course to be counted as both undergraduate and graduate credit and to count the courses toward the masters degree, an undergraduate student must be accepted into the accelerated program and complete a mixed credit form. Acceptance into the program and all approvals must be completed prior to the end of the Change of Schedule Period for the course(s). See the "Graduate College" section for further information.

Entrance Requirements

1. The student must have a minimum of 24 undergraduate hours (or equivalent) in biology. In the case of a student whose preparation for formal graduate study is judged to be inadequate (including cognate areas such as chemistry, physics, or mathematics), a program of prerequisite course work may be outlined for the purpose of properly supplementing his/her preparation. Such courses will not be credited as course requirements for the degree.
2. Candidates for admission to programs in biology are required to have a GPA of at least 2.75 (on a 4.00 scale) for the last 60 semester hours of undergraduate work and a 3.00 average in biology.
3. Scores from the Graduate Record Examination (GRE), General Test must be submitted.
4. A statement of interest and three letters of reference are required for admission to the degree program.

Degree Requirements (32 hours total)

1. **Program of Study.** The program for each candidate will be structured by the candidate's committee in consultation with the student, and must include at least 32 semester hours of graduate credit. Evaluation of previous training and academic objectives will be important factors in establishing this program.
2. **Biology Requirement** (minimum 23 semester hours). A minimum of 16 hours of biology from courses numbered 700-799 inclusive.
3. **Electives** (maximum 9 semester hours). Approved graduate courses may be selected from related fields to a maximum of 9 hours. Any deviation from this maximum will require approval by department head.
4. **Research.** For both options, the student is required to give an oral presentation of his/her work to the Department.
 1. *Thesis Option:* Completion of a satisfactory thesis in the candidate's discipline (maximum of 6 hours of [BIO 798](#) and 6 hours of [BIO 799](#)).
 2. *Non-thesis Option:* After an unsuccessful attempt at a thesis, and with the permission of the thesis committee and department head, a student may switch to a non-thesis option. This requires the completion of a minimum of two degree papers, each of which shall require an extensive paper or major creative work. Four hours of [BIO 790](#) and four hours of [BIO 798](#) may be counted toward this degree under this option.
5. **Comprehensive Examination.** Both a written and an oral comprehensive examination must be passed by the candidate before a degree will be granted.

The written examination is taken after most of the course work has been completed, and is written and evaluated by the student's thesis committee. The examination can include comprehensive questions in biology and questions specific to the area of study chosen by the student. The use of computers is encouraged, where appropriate, for the written examination. The oral examination follows the presentation of the student's thesis research or degree paper to the faculty. The examination tests the student's understanding of the research or degree paper.

Master of Science, Plant Science

[See "Darr School of Agriculture".](#)

Master of Natural and Applied Science

This is an interdisciplinary program within the College of Natural and Applied Science. Accelerated master's program available. [See "Master of Natural and Applied Science".](#)

Master of Science in Education, Secondary Education: Biology Area of Emphasis

Contact Dr. Georgianna Saunders or Dr. Janice Greene and [see program requirements for the M.S.Ed., Secondary Education under Interdisciplinary Graduate Programs.](#)

Biology Requirements

Biology courses that includes a minimum of 3 hrs in courses numbered 700 or above to **total 15 hours**.

Master of Science in Education, Secondary Education: Natural Science Area of Emphasis

Contact Dr. Tamera Jahnke and [see program requirements for the M.S.Ed., Secondary Education under Interdisciplinary Graduate Programs](#).

Natural Science Prerequisite and Requirements

In this option, students complete a minimum of 15 hours with course work selected from two of the following disciplines: Biology, Chemistry, Geography and/or Geology, Mathematics, and Physics. A minimum of 3 hours of course work numbered 700 or above must be included. The prerequisite requirements are those listed in the departmental statements of both selected academic areas of emphasis.

Courses from one of the above disciplines	9 hrs
Courses from a second of the above disciplines	6 hrs
Total	15 hrs

Additional Opportunities

In addition to working in the department, a student may take courses or do research at the Gulf Coast Research Laboratory, Ocean Springs, Mississippi or the State Fruit Experiment Station, Mountain Grove, Missouri. Also, the University operates the Bull Shoals Field Station in Taney County, Missouri.

Biology Courses

BIO 605 Human Nature

Recommended Prerequisite: general biology with evolution; genetics; college algebra; and introductory psychology. A survey of current biological research on the behavioral, psychological, and cognitive dimensions of human biology. This course emphasizes the evolution and function of human social behaviors and value systems, but also addresses the genetics of human psychological diversity, the genetics of human-ape divergence, and the neurobiology of human cognition. May be taught concurrently with BIO 505. Cannot receive credit for both BIO 605 and BIO 505. 3(3-0) F

BIO 608 Environmental Microbiology

Recommended Prerequisite: microbiology. The study of the ecology of microorganisms and the applied use of microorganisms by man in the environment. Laboratory will emphasize current methods used in the field of environmental microbiology. May be taught concurrently with BIO 508. Cannot receive credit for both BIO 508 and BIO 608. 3(2-2) F

BIO 609 Stream Ecology

Recommended Prerequisite: ecology course and one year of college chemistry. The interdisciplinary study of running waters, including study of the physical and chemical environment, trophic interactions, nutrient cycling, and the multiple impacts of humans on modifying these systems. Lectures, group discussion of readings, and laboratory and field exercises. One all-day Saturday field trip required. May be taught concurrently with BIO 509. Cannot receive credit for both BIO 509 and BIO 609. 4(2-4) SO

BIO 611 Immunology

Recommended Prerequisite: microbiology or molecular/cellular biology. A study of the immune system with emphasis on molecular and cellular mechanisms underlying host-microbe interactions, allergy, transplant rejection, cancer surveillance, and autoimmune disease. Laboratory emphasis on techniques used to address research and diagnostic problems. Supplemental course fee. May be taught concurrently with BIO 511. Cannot receive credit for both BIO 511 and BIO 611. 4(3-2) F

BIO 613 Industrial Microbiology

Recommended Prerequisite: microbiology course. An introduction to the fundamental concepts of industrial and applied microbiology. The industrial production of proteins, metabolites, polymers, biocides, and vaccines will be discussed in addition to biotransformations and environmental applications. Production improvement strategies that employ both physical and modern molecular techniques will be introduced. Laboratory will emphasize the selection of industrially important microorganisms, the theory and operation of a fermentor for the production of proteins, antibiotics, and steroids, use of analytical equipment for monitoring product formation, enzymes analysis, downstream processing, and bio-reactor construction and design. May be taught concurrently with BIO 512. Cannot receive credit for both BIO 512 and BIO 613. 3(2-2) S

BIO 616 Evolution

Recommended Prerequisite: genetics course; and college algebra or pre-calculus mathematics course. A survey of modern evolutionary biology, including the evidence that supports the theory of evolution, the natural processes that cause evolution, patterns and mechanisms of speciation, and methods for estimating evolutionary relationships. May be taught concurrently with BIO 515. Cannot receive credit for both BIO 515 and BIO 616. 3(3-0) F,S

BIO 617 Microbial Physiology and Metabolism

Recommended Prerequisite: microbiology course and organic chemistry course. Physiology and anatomy of microorganisms including adaptive responses to environmental changes and microbial metabolic diversity will be discussed. Laboratory will emphasize selective isolation and identification of microorganisms, the growth dynamics of microorganisms, and responses by microorganisms to environmental changes. May be taught concurrently with BIO 517. Cannot receive credit for both BIO 517 and BIO 617. 4(2-4) F

BIO 618 Regulatory Mechanisms

Recommended Prerequisite: genetics, molecular/cellular biology, microbiology, or biochemistry. The regulation of gene expression and protein/enzyme activity in prokaryotes, eukaryotes and viruses. A content-based lecture and discussion course utilizing both textbook and primary literature. May be taught concurrently with BIO 518. Cannot receive credit for both BIO 618 and BIO 518. 2(1-2) S

BIO 620 Pathogenic Microbiology

Recommended Prerequisite: microbiology course. Fundamental principles of pathogenic microbiology; transmission, infection and control of the pathogen. May be taught concurrently with BIO 520. Cannot receive credit for both BIO 520 and BIO 620. 3(3-0) S

BIO 621 Marine Science for Teachers I

Prerequisite: 12 hours in biology. Recommended Prerequisite: genetics course. A course designed to introduce students, particularly inservice teachers, to the study of marine science and to promote the teaching of marine biology at all grade levels. Must be taken at the Gulf Coast Research Laboratory, Ocean Springs, Mississippi. May be taught concurrently with BIO 521. Cannot receive credit for both BIO 521 and BIO 621. 2(2-0) Su

BIO 623 Marine Science for Teachers I Lab

Prerequisite: concurrent enrollment in BIO 621. Laboratory portion of BIO 621. Must be taken at the Gulf Coast Research Laboratory, Ocean Springs, Mississippi. May be taught concurrently with BIO 522. Cannot receive credit for both BIO 522 and BIO 623. 1(0-2) Su

BIO 627 Field Biology

Prerequisite: permission of instructor. Field work during an extended field trip to a specific region of North America to familiarize the student with the flora and/or fauna of that region. Course is scheduled irregularly during academic breaks and may be preceded by several lectures in preparation for the trip. May be repeated to a total of 6 credits with a maximum of 3 credits to be applied to the major in biology. Supplemental course fee (variable by section). May be taught concurrently with BIO 527. Cannot receive credit for both BIO 527 and BIO 627. 1-4 D

BIO 629 Phycology

Recommended Prerequisite: ecology course. The structure, function, ecological significance, and diversity of algae. Emphasis will be placed on field studies, isolation and growth, and physiological characteristics. May be taught concurrently with BIO 530. Cannot receive credit for both BIO 530 and BIO 629. 3(2-2) S

BIO 632 Principles of Fisheries Management

Recommended Prerequisite: ecology or wildlife management course. Life history, population ecology, and management of exploited freshwater and marine species. Scientific sampling and analysis of fishery populations. Characterization, history, and management principles for representative commercial and recreational fisheries. May be taught concurrently with BIO 532. Cannot receive credit for both BIO 532 and BIO 632. 3(2-2) S

BIO 633 Wetland Ecology

Recommended Prerequisite: ecology course; and one year of college chemistry. The composition, structure, function, and importance of wetland ecosystems. Comparisons of different wetland types, hydrology, nutrient cycles, plants and animals and their adaptations, and conservation strategies. May be taught concurrently with BIO 533. Cannot receive credit for both BIO 533 and BIO 633. 3(2-2) F

BIO 635 Coastal Vegetation Lab

Prerequisite: concurrent enrollment in BIO 641. Laboratory portion of BIO 641. Must be taken at the Gulf Coast Research Laboratory, Ocean Springs, Mississippi. May be taught concurrently with BIO 535. Cannot receive credit for both BIO 535 and BIO 635. 1(0-2), Su

BIO 636 Plant Ecology

Recommended Prerequisite: ecology course. The dynamics, structure, and distribution of plant populations and communities, with emphasis on interactions among plants, plants and other organisms, and plants and ecosystems. Laboratory emphasis on experimental studies in the greenhouse and field. Weekend field trip is required. BIO 436 may be taught concurrently with BIO 636. Cannot receive credit for both BIO 436 and BIO 636. 4(2-4) F

BIO 637 Salt Marsh Plant Ecology

Prerequisite: permission of advisor or department head. Recommended Prerequisite: general biology II, plant taxonomy, ecology and plant physiology course. A study with emphasis on the botanical aspects of local marshes; includes plant identification, composition, structure, distribution, and development of coastal marshes. Biological and physical interrelationships. Primary productivity and relation of marshes to estuaries and associated fauna. Must be taken at the Gulf Coast Research Laboratory, Ocean Springs, Mississippi. May be taught concurrently with BIO 537. Cannot receive credit for both BIO 537 and BIO 637. 2(2-0) Su

BIO 638 Salt Marsh Plant Ecology Lab

Prerequisite: concurrent enrollment in BIO 637. Laboratory portion of BIO 637. Must be taken at the Gulf Coast Research Laboratory, Ocean Springs, Mississippi. May be taught concurrently with BIO 538. Cannot receive credit for both BIO 538 and BIO 638. 2(0-4) Su

BIO 639 Biogeography

Recommended Prerequisite: general biology I and II courses. Study of patterns of distribution of organisms in space and in time. May

be taught concurrently with BIO 539. Cannot receive credit for both BIO 539 and BIO 639. 2(2-0) F

BIO 640 App of Molecular Markers

Prerequisite: permission. Recommended Prerequisite: genetics course. Introduction to the use of molecular markers in biological research. Topics covered include methods for identifying genetic variation at the molecular level (protein electrophoresis, automatic DNA sequencing, RAPDs, RFLPs, AFLPs, microsatellites) and their applications to research in systematics, ecology, evolution, conservation biology, forensics, and gene mapping. Students will complete research projects using one or more of the techniques learned. Supplemental course fee. May be taught concurrently with BIO 540. Cannot receive credit for both BIO 540 and BIO 640. 4(2-4) FO

BIO 641 Coastal Vegetation

Prerequisite: 10 hours of biology and permission of advisor or department head. Recommended Prerequisite: general biology I and II courses. A broad study of the general and specific aspects of coastal vegetation, with emphasis on local examples. Vegetational composition, variation, succession, climax, and distribution. Includes aerial techniques, plant identification, delineation of vegetational types and mapping. Must be taken at the Gulf Coast Research Laboratory, Ocean Springs, Mississippi. May be taught concurrently with BIO 534. Cannot receive credit for both BIO 534 and BIO 641. 2(2-0) Su

BIO 644 Plant Physiology

Recommended Prerequisite: organic chemistry course. Basic chemical and physical principles of plant function considering water relationships, nutrient transport, mineral nutrition, photosynthesis, respiration, and phytohormones. May be taught concurrently with BIO 544. Cannot receive credit for both BIO 544 and BIO 644. 4(3-2) D

BIO 650 Statistical Methods for Biologists

Recommended Prerequisite: genetics course and pre-calculus mathematics course. Scientific methodology, experimental design, statistical analysis, and data interpretation applied to biological questions. May be taught concurrently with BIO 550. Cannot receive credit for both BIO 550 and BIO 650. 3(3-0) F,S

BIO 651 Advanced Statistical Methods for Biologists

Recommended Prerequisite: statistics course. The design and analysis of biological experiments, with an emphasis on the choice and interpretation of inferential statistics. Topics covered include causal inference, statistical power, general linear models, repeated measures designs, log-linear models, nonparametric procedures, and computer-intensive techniques. The use of computer software to analyze real data sets from the biological literature is emphasized. May be taught concurrently with BIO 551. Cannot receive credit for both BIO 551 and BIO 651. 2(1-2) S

BIO 654 Marine Ichthyology

Prerequisite: 16 hours of biology and permission of advisor or department head. Recommended Prerequisite: General Biology I and II, Genetics and Comparative Vertebrate Anatomy. This course provides the student with a strong general background in the biology of marine fishes. Emphasis placed on the principles involved in the classification and taxonomy of marine and estuarine fishes. Must be taken at the Gulf Coast Research Laboratory, Ocean Springs, Mississippi. May be taught concurrently with BIO 555. Cannot receive credit for both BIO 555 and BIO 654. 3(3-0) Su

BIO 656 Marine Ichthyology Lab

Prerequisite: concurrent enrollment in BIO 654. Laboratory portion of BIO 654. Must be taken at the Gulf Coast Research Laboratory, Ocean Springs, Mississippi. May be taught concurrently with BIO 556. Cannot receive credit for both BIO 556 and BIO 656. 3(0-6) Su

BIO 657 Marine Fisheries Management

Prerequisite: permission of instructor; and concurrent enrollment in BIO 658. A course designed to familiarize students with practical marine fisheries management problems in today's real world. Covers the international and local, economic, social, legal, and political, as well as biological factors that are considered in decisions directed toward achieving optimum sustainable yield from marine resources. The history of management schemes, sources of information, current status of fishing technology, management methods, legal problems and educational needs are explored. Must be taken at the Gulf Coast Research Laboratory, Ocean Springs, Mississippi. May be taught concurrently with BIO 557. Cannot receive credit for both BIO 557 and BIO 657. 2(2-0) Su

BIO 658 Marine Fisheries Management Lab

Prerequisite: concurrent enrollment in BIO 657. Laboratory portion of BIO 657. Must be taken at the Gulf Coast Research Laboratory, Ocean Springs, Mississippi. May be taught concurrently with BIO 558. Cannot receive credit for both BIO 558 and BIO 658. 2(0-4) Su

BIO 659 Population Genetics and Evolutionary Mechanisms

Recommended Prerequisite: evolution course and statistics course. The theory of genetic variation in populations, with emphasis on quantitative description of the mechanisms of biological evolution. May be taught concurrently with BIO 560. Cannot receive credit for both BIO 560 and BIO 659. 3(3-0) D

BIO 661 Environmental Issues Education and Interpretation

Prerequisite: permission of instructor. Discussion of environmental issues, practical experiences in teaching environmental concepts, and awareness of environmental resource materials for the formal and nonformal educational setting. May be taught concurrently with BIO 561. Cannot receive credit for both BIO 661 and BIO 561 2(1-2) D

BIO 662 Limnology

Recommended Prerequisite: ecology course; and one year of college chemistry. Physical, chemical, and biological characteristics of lakes and reservoirs. Laboratory includes mapping, lake models, water chemistry, and surveys of diversity and abundance. Two all-day Saturday labs required. May be taught concurrently with BIO 562. Cannot receive credit for both BIO 562 and BIO 662. 4(2-4) F

BIO 663 Population Ecology

Recommended Prerequisite: ecology course and pre-calculus mathematics course. Discussion of factors controlling the distribution and abundance of populations. Quantitative description of population dynamics is emphasized. May be taught concurrently with BIO 563. Cannot receive credit for both BIO 563 and BIO 663. 3(2-2) SE

BIO 664 Ozarks Natural Communities

Recommended Prerequisite: BIO 369. Examination of forests, glades, and aquatic habitats with focus on environmental issues in the Ozarks. Integration into formal and non-formal educational settings will be covered. May be taught at the Bull Shoals Field Station. May be taught concurrently with BIO 564. Cannot receive credit for both BIO 664 and BIO 564. 2(1-2) D

BIO 665 Marine Ecology

Prerequisite: 16 hours of biology and permission of advisor or department head. Recommended Prerequisite: General Biology I and II. A consideration of the relationship of marine organisms to their environment includes the effects of temperature, salinity, light, nutrient concentration, currents, and food on the abundance and distribution of marine organisms. Must be taken at the Gulf Coast Research Laboratory, Ocean Springs, Mississippi. Concurrent enrollment in BIO 566 required. May be taught concurrently with BIO 565. Cannot receive credit for both BIO 565 and BIO 665. 3(3-0) Su

BIO 666 Marine Ecology Lab

Prerequisite: concurrent enrollment in BIO 665. Laboratory portion of BIO 665. Must be taken at the Gulf Coast Research Laboratory, Ocean Springs, Mississippi. May be taught concurrently with BIO 566. Cannot receive credit for both BIO 566 and BIO 666. 2(0-4) Su

BIO 668 Physiological Ecology

Recommended Prerequisite: ecology course; and general physiology or plant physiology or human physiology course. Physiological adaptations of plants and animals to environmentally stressful conditions and to ecological/evolutionary pressures. May be taught concurrently with BIO 567. Cannot receive credit for both BIO 567 and BIO 668. 4(4-0) SO

BIO 671 Comparative Animal Physiology

Recommended Prerequisite: general physiology or human physiology course. Organ/system function in a wide range of invertebrate and vertebrate animals. May be taught concurrently with BIO 571. Cannot receive credit for both BIO 571 and BIO 671. 4(3-3) SO

BIO 673 Ornithology

Prerequisite: 12 hours of biology. Taxonomy, distribution, life histories and ecology of birds; emphasis on Missouri forms. Early morning field trips required. May be taught concurrently with BIO 573. Cannot receive credit for both BIO 573 and BIO 673. 3(2-2) S

BIO 674 Aquatic Entomology

Aquatic insects, ecology and taxonomy with emphasis on field applications. May be taught concurrently with BIO 574. Cannot receive credit for both BIO 574 and BIO 674. 2(1-3) SE

BIO 675 Ichthyology

Prerequisite: 12 hours in biology. Taxonomy, distribution, life histories and ecology of fish with emphasis on Missouri forms. May be taught concurrently with BIO 575. Cannot receive credit for both BIO 575 and BIO 675. 3(2-2) F

BIO 676 Herpetology

Prerequisite: 12 hours in biology. Taxonomy, distribution, life histories and ecology of amphibians and reptiles with emphasis on Missouri forms. One weekend field trip required. May be taught concurrently with BIO 576. Cannot receive credit for both BIO 576 and BIO 676. 3(2-2) S

BIO 677 Mammalogy

Prerequisite: 12 hours in biology. Taxonomy, distribution, life histories and ecology of mammals with emphasis on Missouri forms. One weekend field trip required. May be taught concurrently with BIO 577. Cannot receive credit for both BIO 577 and BIO 677. 3(2-2) F

BIO 678 Behavioral Ecology

Recommended Prerequisite: ecology course and statistics course. Fundamental principles of animal behavior with an emphasis on the study of the ecological and evolutionary processes that influence behavior. May be taught concurrently with BIO 578. Cannot receive credit for both BIO 578 and BIO 678. 4(3-2) S

BIO 679 Conservation Biology

Recommended Prerequisite: genetics course and ecology course. An in-depth examination of the science of conservation from a biological perspective, with an examination of ethical and legal aspects of conservation. May be taught concurrently with BIO 579. Cannot receive credit for both BIO 579 and BIO 679. 4(3-2) D

BIO 680 Vertebrate Anatomy and Evolution

Vertebrate gross anatomy. Phylogeny and present status of organ systems in vertebrates. May be taught concurrently with BIO 380. Cannot receive credit for both BIO 380 and BIO 680. 2(2-0) F

BIO 685 Marine Conservation

An overview of current issues related to the conservation and management of marine organisms, with emphasis on marine species and habitats exploited or endangered by human actions. BIO 485 may be taught concurrently with BIO 685. Cannot receive credit for both BIO 685 and 485. 1-3 D

BIO 686 Fish Ecology

Recommended Prerequisite: ecology course and ichthyology course. The biology of fishes in relation to environmental conditions at the individual, population, and community levels. May be taught concurrently with BIO 584. Cannot receive credit for both BIO 584 and BIO 686. 3(3-0) D

BIO 687 Marine Invertebrate Zoology

Prerequisite: 16 hours in biology; and concurrent enrollment in BIO 688. A concentrated study of the free-living marine and estuarine invertebrates of Mississippi Sound and adjacent bayous, salt marshes, barrier islands, and the nearshore continental shelf of the northeastern Gulf of Mexico. Course emphasizes structure, classification, phylogenetic relationships, larval development, functional processes, and ecological aspects of Gulf of Mexico invertebrates and their natural assemblages. Advanced undergraduates and graduate students may be asked to conduct independent, short-term research projects during the course. Must be taken at the Gulf Coast Research Laboratory, Ocean Springs, Mississippi. May be taught concurrently with BIO 587. Cannot receive credit for both BIO 587 and BIO 687. 3(3-0) Su

BIO 688 Marine Invertebrate Zoology Lab

Prerequisite: concurrent enrollment in BIO 687. Laboratory portion of BIO 687. May be taught concurrently with BIO 588. Cannot receive credit for both BIO 588 and BIO 688. 3(0-6) Su

BIO 689 Game Management

Recommended Prerequisite: wildlife management course. Management of game birds and mammals for recreational utilization. May be taught concurrently with BIO 589. Cannot receive credit for both BIO 589 and BIO 689. 3(3-0) D

BIO 697 Topics in Biology

Prerequisite: permission of instructor. A variable content course to provide for the offering of selected topics in biology on a one time or first-time basis. May be repeated for credit when topic varies. May be taught concurrently with BIO 597. Cannot receive credit for both BIO 597 and BIO 697. 1-4 D

BIO 710 Topics in Microbial Physiology

Topics of interest in microbial physiology will be discussed. These may include, cell structure, energy production, fermentation, nitrogen metabolism, protein and nucleic acid syntheses, regulation of gene expression, and dynamics of cell growth. Lecture will supplement discussion sessions. 3(3-0) D

BIO 712 Advanced Immunology

Recommended Prerequisite: immunology course. Cellular aspects of the immune system. 2(2-0) S

BIO 725 Advanced Limnology

Recommended Prerequisite: limnology course. Advanced concepts of biological, chemical and physical limnology. Recent symposia,

reviews, and primary literature are discussed. Prerequisite: BIO 562. Advanced concepts of biological, chemical and physical limnology. Recent symposia, reviews, and primary literature are discussed. 2(2-0) D

BIO 726 Advanced Limnology Methods

Recommended Prerequisite: limnology course. Research and practical application of modern limnological methods are taught. 2(0-4) D

BIO 728 Recent Advances in Biology

Prerequisite: permission of instructor. Selected topics in biology to be discussed using original literature as the focal point. Variable content course. May be repeated when topic varies. 1(0-2) F,S

BIO 730 Advanced Topics in Biology

Prerequisite: permission of instructor. Individual study in biology; may include literature, field and/or laboratory work. May be repeated. 1-4 F,S

BIO 734 Advanced Plant Taxonomy

Prerequisite: permission of instructor. Philosophy and principles of modern taxonomic procedures. 4(2-4) D

BIO 755 Advanced Developmental Biology

Recommended Prerequisite: cell biology course. An in-depth study of the molecular and cellular mechanisms involved in the development of vertebrate, invertebrate, and plant systems. Lectures will emphasize fertilization, morphogenesis, differentiation, induction, regeneration, and neoplasia. Laboratory exercises will emphasize techniques utilized by developmental biologists. Review of current literature and poster presentations will be required. Cannot receive credit for both BIO 355 and BIO 755. 4(3-2) S

BIO 760 Topics in Teaching Biology

Prerequisite: permission of instructor. Biological concepts, information, practical experiences, and use of resource materials in the elementary and secondary classroom. Variable content course. May be repeated when topic varies. 1-3 D

BIO 767 Advanced Vertebrate Zoology

Evolutionary relationships of living and extinct vertebrates; analysis of geographic distribution and adaptive radiation. Includes field/lab experiences to be arranged. 3(2-2) D

BIO 790 Degree Paper

Prerequisite: permission of advisor. Extensive paper on selected topics. Exclusively satisfies requirements for non-thesis option, which also requires one BIO 690 paper to be presented orally to the department. May be repeated to total of 4 hours. Graded Pass/Not Pass only. 2(2-0) D

BIO 794 Scientific Writing

Organization and methods in scientific writing. Included are discussion of literature searching, scientific methodology, experimental design, proposal writing, figure preparation, editing and oral presentation. Recommended for graduate students in biology, preferably during the first year of graduate study. 2(2-0) F

BIO 796 Science Internship

Completion of an internship project (480 hours) at a discipline-related business, nonprofit organization, or government agency, approved and supervised by both the departmental and internship advisors. Includes a formal report in the appropriate professional

format, and an oral presentation at an approved venue. Graded Pass/Not Pass only. No more than 6 hours may count toward a masters degree. 1-6 F,S,Su

BIO 798 Research

Prerequisite: permission of advisor. Supervised research in special biology areas. May be repeated, but no more than 6 hours may be counted as credit towards the M.S. degree. Graded Pass/Not Pass only. 1-6 D

BIO 799 Thesis

Prerequisite: permission of advisor. Independent study connected with preparation of thesis. May be repeated, but no more than 6 hours may be counted as credit towards the MS degree. Graded Pass/Not Pass only. 1-6 D



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Department of Chemistry

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Programs

Master of Science, Chemistry

Erich Steinle, Graduate Director

Temple Hall, Room 417, Phone (417) 836-5319

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Program Description

This program is designed to prepare students to work in industrial or governmental chemistry laboratories, or to pursue doctoral studies in chemistry.

Program Objectives

Development of a sound knowledge of chemical principles, acquisition of outstanding research and communication skills, and attainment of an understanding and appreciation of applied chemistry and the importance of multidisciplinary approaches to the solution of scientific problems.

Areas of specialization include analytical chemistry, biochemistry, chemical education, environmental chemistry, inorganic chemistry, materials chemistry (including polymer chemistry and nanotechnology). organic chemistry, and physical chemistry.

Formal courses, graduate seminars, professional advisement, directed research, and a master's thesis will be incorporated into a customized curriculum based on the individual's scholastic background and career goals. On completion of the program, the student will have developed the skills needed for a career in chemical production, development, or research.

Entrance Requirements

Students admitted to the graduate chemistry program in full standing must meet the following requirements:

1. A bachelor's degree from an accredited institution in the U.S. or equivalent training in a foreign university.
2. A minimum overall GPA of 3.00 on a 4.00 scale, or a minimum GPA of 3.00 on a 4.00 scale for the last 60 hours of course work.
3. Scores from the verbal and quantitative sections of the Graduate Record Examination. Normally, students are expected to score at or above the 50th percentile on each section of the GRE and to have an overall college GPA of at least 3.00.
4. International applicants from countries not recognizing English as the primary official language are additionally required to submit a score for the Test of English as a Foreign Language (TOEFL) of not less than 550 (paper-based), 213 (computer-based), or 79 (internet-based) and with a minimum of 50th percentile on the Listening Comprehension Section.
5. A minimum undergraduate background in chemistry consisting of two semesters of general chemistry, two semesters of organic chemistry, one semester of analytical chemistry, and one semester of inorganic chemistry with grades of "C" or better in each course and an overall GPA of not less than 3.00.

Applicants lacking the background courses described in item five above may be admitted, but will be required to rectify any of these deficiencies with appropriate course work. These leveling courses will not apply toward the master's degree.

Students who do not meet the grade point standards outlined above may be granted conditional admission to the program. As conditions of admission, students will be required to complete a minimum of 9 hours of specified graduate courses with a GPA of at least 3.00 to be advanced to full standing in the program.

Accelerated Master's Degree Option

Eligible Missouri State University majors in chemistry may apply for preliminary acceptance into the Master of Science program in Chemistry after admission requirements for the accelerated masters option have been satisfied. If accepted, graduate courses chosen from [CHM 602](#), [CHM 607](#), [CHM 642](#), [CHM 652](#) and [CHM 675](#) may be counted towards both the undergraduate and graduate degrees, with a maximum of 12 credit hours counted towards both the undergraduate and graduate degrees. This option offers an opportunity for chemistry majors with undergraduate laboratory research experience to complete the requirements for the Master of Science degree in Chemistry in two semesters and a summer after attaining the Bachelor's degree, rather than the typical four semesters and a summer. Contact the Department of Chemistry for further information and guidelines.

Before enrolling in a course to be counted as both undergraduate and graduate credit and to count the courses towards the masters degree, an undergraduate student must be accepted into the accelerated program and complete a mixed credit form. Acceptance into the program and all approvals must be completed prior to the end of the Change of Schedule Period for the course(s). See the Graduate College for further information.

Admission Requirements for Accelerated Master's Degree Option

1. Junior standing, a GPA in chemistry of 3.00 or better and an overall GPA of 3.00 or better.
2. Completion of CHM 160, 161, 170, 171, 302, 342, 343, 375, 398, and 399; PHY 123 and 124 or PHY 203 and 204; MTH 287 and 288, or MTH 261 and 280 or MTH 261 and 288 with an overall GPA of 3.00 or better.
3. Undergraduate laboratory research experience in residence in the Department of Chemistry with a supportive recommendation from the student's undergraduate research mentor.
4. Acceptance of applicant by a graduate faculty member who agrees to serve as the student's graduate research mentor.

5. Acceptance of the applicant by the graduate faculty in Chemistry under the accelerated masters option.

Degree Requirements (minimum of 32 hours)

1. **Advisory Committee.** Initially, each student will be advised by the departmental coordinator of graduate studies. As soon as possible, the student will select a faculty member to chair a graduate advisory committee consisting of at least four persons. At least one committee member, but not more than two, shall be from outside the chemistry department. This committee will supervise the remainder of the candidate's graduate program.
2. **Program of Study.** The candidate's program will be structured by the advisory committee in consultation with the student. Academic background, professional experience, placement test scores, and academic objectives will be considered in establishing the individual's program.
3. **Chemistry Requirement.** A minimum of 24 hours in chemistry including at least 16 hours from courses numbered 700 or above with at least 6 hours of 700-level chemistry course work in addition to research, thesis, and colloquium. Students who have not passed (with a C or better) undergraduate courses in physical chemistry, instrumental analysis, advanced organic chemistry, and advanced inorganic chemistry will be required to pass (with a grade of C or better) some or all of the following courses: [CHM 606](#), [CHM 607*](#), [CHM 633](#), [CHM 642](#), [CHM 675](#), and [CHM 675](#). Hours received from these courses will count toward the 32 hours required for the master's degree.

* Students who have had a one-semester physical chemistry course will be given an assessment exam; a score of the 50th percentile or above will satisfy the physical chemistry core course requirement. Students scoring less than the 50th percentile, but higher than the 33rd percentile, will satisfy the physical chemistry core requirement by passing CHM 607.

4. **Colloquium.** 2 hours of credit must be earned in [CHM 700](#), Chemistry Colloquium.
5. **Electives.** Upon approval of the advisory committee, graduate courses from related fields may be selected to a maximum of 8 hours within the 32 hour degree requirement.
6. **Research Requirement.** The maximum credit toward the 32-hour degree requirement is 6 hours of [CHM 798](#) and 6 hours of [CHM 799](#). Submission of a thesis is a specific requirement for the degree. The purpose of the thesis is to demonstrate competence in scientific research and the ability to: choose a research topic of scientific importance; conduct a comprehensive literature search of the problem; design and implement a plan of research; collect and interpret scientific data; and communicate results and findings to peers. An oral defense of the thesis is required.
7. **Comprehensive Examination.** A written comprehensive examination will be administered after most of the course work has been completed. This examination must be passed by the candidate before a degree will be given.

Master of Science, Plant Science

[See Darr School of Agriculture.](#)

Master of Natural and Applied Science

Contact Dr. Bryan Breyfogle and see the interdisciplinary program within the College of Natural and Applied Science. Accelerated master's program available. [See "Master of Natural and Applied Science".](#)

Master of Science in Education, Secondary Education: Chemistry Area of Emphasis

Contact Dr. Bryan Breyfogle and [see program requirements for the M.S.Ed., Secondary Education under Interdisciplinary Graduate Programs.](#)

Chemistry Requirements

Chemistry course work including a minimum of 3 hours in courses numbered 700 or above to **total 15 hours.**

Master of Science in Education, Secondary Education: Natural Science Area of Emphasis

Contact Dr. Tamera Jahnke and [see program requirements for the M.S.Ed., Secondary Education under Interdisciplinary Graduate Programs.](#)

Natural Science Prerequisite and Requirements

In this option, students complete a minimum of 15 hours with course work selected from two of the following disciplines: Biology, Chemistry, Geography and/or Geology, Mathematics, and Physics. A minimum of 3 hours of course work numbered 700 or above must be included. The prerequisite requirements are those listed in the departmental statements of both selected academic areas of emphasis.

Courses from one of the above disciplines	9 hrs
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Courses from a second of the above disciplines	6 hrs
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Total	15 hrs
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Chemistry Courses

CHM 602 Techniques of Instrumental Analysis

Prerequisite: "C-" or better in either CHM 200 or CHM 342; and "C-" or better in CHM 302. Recommended Prerequisite: PHY 124 or PHY 204. Applications of instrumental methods for the separation and analysis of materials; included are potentiometry, photometry and chromatography. Does not apply to a Chemistry major if the student passes CHM 702. May be taught concurrently with CHM 502. Cannot receive credit for both CHM 502 and CHM 602. 4(3-3) F

CHM 605 Fundamentals of Physical Chemistry

Prerequisite: 20 hours of chemistry; and "C-" or better in either MTH 287 or MTH 261. A one semester introduction to physical chemistry including the following topics: thermodynamics, solution chemistry, electrochemistry, kinetics, and atomic and molecular structure. Laboratory experiments will illustrate principles of physical chemistry and techniques of analysis. Does not apply to a Chemistry major if the student passes CHM 606. May be taught concurrently with CHM 505. Cannot receive credit for both CHM 505 and CHM 605. 4(3-3) S

CHM 606 Physical Chemistry I

Prerequisite: "C-" or better in CHM 170; and MTH 280 or MTH 288 or concurrent enrollment in MTH 280 or MTH 288. Recommended Prerequisite: MTH 302; and PHY 124 or PHY 204. First semester of a two-semester series covering aspects of quantum mechanics, classical and statistical thermodynamics, spectroscopy, kinetic theory of gases, and chemical kinetics. A grade of "C-" or better is required in this course in order to take CHM 607. May be taught concurrently with CHM 506. Cannot receive credit for both CHM 606 and CHM 506. 3(3-0) F

CHM 607 Physical Chemistry II

Prerequisite: "C-" grade or better in CHM 506 or 606. Recommended Prerequisite: CHM 375. Second semester of a two-semester series that builds upon and completes the topics introduced in CHM 606. May be taught concurrently with CHM 507. Cannot receive credit for both CHM 607 and CHM 507. 3(3-0) S

CHM 608 Physical Chemistry Laboratory I

Prerequisite: "C-" or better in CHM 302; and "C-" or better in CHM 506 or CHM 606 or concurrent enrollment in CHM 506 or CHM 606.

Experiments in physical chemistry employing principles and techniques reflecting material presented in CHM 506 or 606. May be taught concurrently with CHM 508. Cannot receive credit for both CHM 608 and CHM 508. 2(0-4) F

CHM 609 Physical Chemistry Laboratory II

Prerequisite: CHM 507 or CHM 607 or concurrent enrollment; and CHM 508 or CHM 608. Experiments in physical chemistry employing principles and techniques reflecting material presented in CHM 507 or 607. May be taught concurrently with CHM 509. Cannot receive credit for both CHM 609 and CHM 509. 2(0-4) S

CHM 614 Polymer Chemistry

Prerequisite: "C-" or better in CHM 343 or CHM 344; and CHM 505 or CHM 605 or CHM 506 or CHM 606. Morphology and chemical structure, polymer characterization, chemical structure and polymer properties, vinyl and non-vinyl polymers and mechanism of formation. Inorganic and partially inorganic polymers. May be taught concurrently with CHM 514. Cannot receive credit for both CHM 514 and CHM 614. 3(3-0) SE

CHM 642 Advanced Organic Chemistry

Prerequisite: "C-" grade or better in CHM 343 or CHM 344. Structure, reaction mechanisms, stereochemistry and other topics of theoretical nature in organic and polymer chemistry. May be taught concurrently with CHM 542. Cannot receive credit for both CHM 542 and CHM 642. 3(3-0) F

CHM 652 Biochemistry II

Prerequisite: "C-" or better in CHM 452. Bioenergetics--Metabolism of biomolecules including carbohydrates, lipids, amino acids and nucleotides. Photosynthesis. Nitrogen metabolism. Mechanisms of hormone action. May be taught concurrently with CHM 552. Cannot receive credit for both CHM 552 and CHM 652. 3(3-0) S

CHM 653 Advanced Biochemistry Laboratory

Prerequisite: CHM 453; and CHM 552 or CHM 652 concurrent enrollment in CHM 552 or CHM 652. Emphasis on modern techniques in the biochemistry laboratory; enzymology, protein purification and analysis; protein structure determination; isoelectric focusing; HPLC; trace techniques. Supplemental course fee. May be taught concurrently with CHM 553. Cannot receive credit for both CHM 553 and CHM 653. 2(0-4) D

CHM 675 Advanced Inorganic Chemistry

Prerequisite: "C-" or better in CHM 375; and CHM 507 or CHM 607 or concurrent enrollment in CHM 507 or CHM 607. Theories and techniques of modern inorganic chemistry; correlation of theories with inorganic compounds. May be taught concurrently with CHM 575. Cannot receive credit for both CHM 575 and CHM 675. 3(3-0) S

CHM 697 Special Topics in Chemistry

Prerequisite: 18 hours of chemistry. Selected topics of a theoretical or applied nature. May be repeated up to a total of 6 hours with differing topics. May be taught concurrently with CHM 597. Cannot receive credit for both CHM 597 and CHM 697. 1-3 D

CHM 700 Chemistry Colloquium

A series of oral presentations on new developments in chemistry. Presentations to be made by faculty members, students, and guest speakers from industry and academe. One of the requirements of this course is an oral presentation. May be repeated, but not more than 2 hours may be counted toward the 32-hour requirement for the MS in Chemistry degree. 1(1-0) F,S

CHM 701 Chemistry Seminar

Attendance at oral presentations on new developments in chemistry. Presentations may include those made by departmental faculty members, departmental graduate students, guest speakers from industry and academe and ACS tour speakers. All graduate students not enrolled in CHM 700 must be enrolled in CHM 701. Hours earned will not count toward the 32-hour requirement for the MS in Chemistry degree. Graded Pass/Not Pass only. 1(1-0) F,S

CHM 702 Advanced Topics in Analytical Chemistry

Prerequisite: CHM 602. An advanced topic in analytical chemistry will be addressed via faculty lectures and student projects. Examples of proposed topics include: electroanalytical methods, nanotechnology, forensic chemistry and data acquisition methods. Variable content course. May be repeated to a total of 6 hours with differing topics. 3(3-0) D

CHM 710 Special Topics in Chemical Education

Prerequisite: coursework sufficient to meet Missouri certification standards in chemistry for secondary teaching or permission. A single topic of current interest in the teaching of chemistry will be considered. May be repeated to a total of 9 hours provided the topics are different. 1-3 D

CHM 720 Topics in Theoretical Chemistry

Prerequisite: coursework sufficient to meet Missouri certification standards in chemistry for secondary teaching or permission. Nature of matter including atomic structure, chemical bonding and spectroscopy. 3(3-0) D

CHM 735 Investigation in Chemistry for Teachers

Prerequisite: coursework sufficient to meet Missouri certification standards for secondary/middle school science teaching. Techniques in performing science investigation with application to secondary and middle school science. May be taught concurrently with CHM 435. Cannot receive credit for both CHM 435 and CHM 735. 3(1-4) S

CHM 740 Seminar

Extensive paper on selected topics to be read before staff seminars. May be repeated to total 4 hours. 2(2-0) D

CHM 742 Physical Organic Chemistry

Prerequisite: CHM 642. An in-depth study of the experimental techniques and physical principles used for the determination of organic reaction mechanisms. 3(3-0) D

CHM 752 Advanced Topics in Biochemistry

Prerequisite: CHM 652. An advanced topic in biochemistry will be addressed via faculty lectures and student projects. Examples of proposed topics include: carbohydrates, the cell surface, and physical biochemistry. Variable content course. May be repeated to a total of 6 hours with differing topics. 3(3-0) SO

CHM 760 Chemistry of Environmental Systems I

Chemistry of water and soil, water treatment, agricultural chemistry, and related topics. May be taught concurrently with CHM 460. Cannot receive credit for both CHM 460 and CHM 760. 3(3-0) F

CHM 761 Chemistry of Environmental Systems II

Prerequisite: CHM 760. Recommended Prerequisite: some advanced coursework in chemistry, geosciences, biology, or related fields. Atmospheric chemistry; pollution issues related to power production and transportation; energy sources and fuels. May be taught concurrently with CHM 461. Cannot receive credit for both CHM 761 and CHM 461. 3(3-0) S

CHM 762 Chemistry of Environmental Systems Laboratory

Prerequisite: CHM 760 or concurrent enrollment. Techniques and procedures for environmental monitoring to test natural samples. Applications and limitations of wet chemical and instrumental methods such as atomic absorption, gas chromatography, and absorption spectrophotometry. May be taught concurrently with CHM 462. Cannot receive credit for both CHM 462 and CHM 762. 2(0-4) S

CHM 770 Chemical Kinetics

Prerequisite: CHM 606. Fundamental concepts of chemical kinetics and dynamics, from both macroscopic and molecular level perspectives. An emphasis will be placed on the interpretation of gas, liquid, surface and catalyst reaction kinetics and mechanisms. 3 (3-0) FO

CHM 771 Chemical Bonding

Prerequisite: CHM 607. Quantum mechanics; atomic and molecular structure; computational procedures. Independent study project required. 3(3-0) FE

CHM 775 Organometallic Chemistry

Prerequisite: CHM 675. An in-depth examination of the structure, properties, and reactions of molecules containing one or more metal atoms bonded to organic fragments. 3(3-0) FE

CHM 790 Advanced Topics in Chemistry

Detailed treatment of various advanced topics in chemistry. Topics may include: water analysis, physical chemistry of macromolecules, chemistry of natural products, surface chemistry, and forensic chemistry. Variable content course. May be repeated to a total of 6 hours with differing topics. 1-3 D

CHM 796 Science Internship

Completion of an internship project (480 hours) at a discipline-related business, nonprofit organization, or government agency, approved and supervised by both the departmental and internship advisors. Includes a formal report in the appropriate professional format, and an oral presentation at an approved venue. Graded Pass/Not Pass only. No more than 6 hours may count toward a masters degree. 1-6 F,S,Su

CHM 798 Research

Supervised research in special chemistry areas. May be repeated, but not more than 6 hours of CHM 798 may be counted toward the 32-hour requirement for the MS degree. 1-4 F,S

CHM 799 Thesis

Independent research and study connected with preparation of thesis. Not more than 6 hours of CHM 799 may be counted toward the 32-hour requirement for the MS degree. 1-6 D

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Graduate College
2012-13 Graduate Catalog

First Edition
published July 2012

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Department of Computer Science

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Email: ComputerScience@missouristate.edu

Website: <http://www.computerscience.missouristate.edu>

Department Head: Kenneth R. Vollmar

Faculty

Professor: Lloyd A. Smith, Kenneth Vollmar, Yang Wang

Associate Professor: Jamil Saquer, Hui Liu, Eric Shade

Emeritus Professor: Melvin V. Foster, Ivon Lowsley, Jr.

No master's degree program is offered in Computer Science. However, the department participates in the Interdisciplinary Master of Natural and Applied Science program. The following courses may be taken for graduate credit by students admitted to graduate study at Missouri State University.

Programs

Master of Natural and Applied Science

[See Master of Natural and Applied Science \(Interdisciplinary Program\). Accelerated master's program available.](#)

Computer Science Courses

CSC 600 Hardware, Software, and Troubleshooting Personal Computers

An introduction to the installation, maintenance, troubleshooting, upgrading, simple repair, and management of personal computers found in educational settings. This course will provide numerous laboratory experiences providing hands-on experience with the goal of enabling students to support personal computer laboratories found in PK-12 schools. May be taught concurrently with CSC 500. Cannot receive credit for both CSC 500 and CSC 600. 3(2-2) D

CSC 605 Web-Based Resources in Educational Settings

An introduction to the design, implementation, and management of World Wide Web resources over the Internet and Intranet networks. Topics include Internet overview, web authoring, web programming, server setting and maintenance. The objective of the course is to

know tools (HTML, JavaScript, and Java applets, and Internet Server software, and Navigator/Internet Explorer software packages), and their applicability in WWW design and management in PK-12 school settings. May be taught concurrently with CSC 505. Cannot receive credit for both CSC 505 and CSC 605. 2(2-0) D

CSC 610 Networking and Telecommunications in Educational Settings

An introduction to networking and data communications from an educator's perspective. The course will examine the necessary computer hardware, software, and personnel resources relevant to networking and data communication requirements in various educational settings. Local Area Networks, Wide Area Networks, Network Interconnections, and the Internet will be addressed. May be taught concurrently with CSC 510. Cannot receive credit for both CSC 510 and CSC 610. 2(2-0) D

CSC 621 Compiler Construction

Topics include lexical analysis, parsing, symbol tables, type checking, run-time organization, code generation, basic code optimization, and the use of compiler development tools. The student must write a complete compiler for a small imperative programming language. May be taught concurrently with CSC 521. Cannot receive credit for both CSC 521 and CSC 621. 4(3-2) D

CSC 625 Computer Graphics

An introduction to computer graphics, with an emphasis on application programming. Algorithms for two dimensional graphics, including windowing, clipping, and transformations; algorithms for three dimensional graphics, including viewing, transformations, and removal of hidden lines and surfaces. Data structures for graphics and interactive techniques will be stressed. May be taught concurrently with CSC 525. Cannot receive credit for both CSC 625 and CSC 525. 3(3-0) F

CSC 626 Methods of Optimization

Convex sets, classical optimization of functions, constrained optimization, search techniques, linear and nonlinear optimization, applications to applied problems. May be taught concurrently with CSC 526. Cannot receive credit for both CSC 526 and CSC 626. 3(3-0) D

CSC 635 Data Mining

Recommended Prerequisite: equivalent of CSC 232. This course studies the emerging technology of data mining - the automated extraction of patterns and information from data. The focus will be on understanding the algorithms underlying data mining and on the practical use of those algorithms. Students will use data mining software to analyze collections of data. May be taught concurrently with CSC 535. Cannot receive credit for both CSC 635 and CSC 535. 3(3-0) D

CSC 640 Introduction to Artificial Intelligence

Recommended Prerequisite: equivalent of CSC 325. Modern techniques for the implementation of goal-directed behavior in intelligent systems, including knowledge representation, search, perception, reasoning, and learning. May be taught concurrently with CSC 540. Cannot receive credit for both CSC 640 and CSC 540. 3(3-0) S

CSC 645 Computer Speech, Music and Images

This is an applied course focusing on the technical aspects of computer-based multimedia-speech, music, audio, and video. In any given semester, the focus may be more on audio or image processing, or it may be equally balanced between the two. Topics include multimedia data capture and representation, methods of data compression, multimedia information retrieval, and multimedia standards. May be taught concurrently with CSC 545. Cannot receive credit for both CSC 645 and CSC 545. 3(3-0) D

CSC 665 Computer Networks

An introduction to the theory, concepts and techniques upon which modern computer networks and telecommunication systems are

based. The emphasis will be on layered network architectures, the design frameworks for both local and wide area networks and communication protocols. May be taught concurrently with CSC 565. Cannot receive credit for both CSC 665 and CSC 565. 3(3-0) F

CSC 667 Wireless Networks

An introduction to the fundamental theory, concepts and techniques of wireless communication, wireless networks, network architecture, and wireless applications. Students will gain an understanding of the significance that wireless systems and user mobility have on the construction and handling of a data or telecommunications network. Topics include wireless and ad hoc networks, enabling technologies, multiplexing, protocol design, network security, and quality of service. May be taught concurrently with CSC 567. Cannot receive credit for both CSC 667 and CSC 567. 3(3-0) S

CSC 687 Computing for Bioinformatics

This course focuses on computational techniques used in bioinformatics. Topics will include nucleotide and amino acid data representation, sequence alignment, coding sequence prediction, and use of statistical models. Students will learn to use bioinformatics libraries with a script language such as Python or Perl. May be taught concurrently with CSC 587. Cannot receive credit for both CSC 687 and CSC 587. 3(3-0) D

CSC 690 Advanced Topics in Computer Science

Detailed consideration of advanced topics in the field of Computer Science. Topics will change, and this course may be repeated with differing topics. May be taught concurrently with CSC 590. Cannot receive credit for both CSC 690 and CSC 590. 1-4 D

CSC 696 Special Readings

Prerequisite: permission of department head. Periodic conferences with an advisor are required. May be repeated to a total of 6 hours. May be taught concurrently with CSC 596. Cannot receive credit for both CSC 596 and CSC 696. 1-3 F,S

CSC 796 Science Internship

Completion of an internship project (480 hours) at a discipline-related business, nonprofit organization, or government agency, approved and supervised by both the departmental and internship advisors. Includes a formal report in the appropriate professional format, and an oral presentation at an approved venue. Graded Pass/Not Pass only. No more than 6 hours may count toward a masters degree. 1-6 F,S,Su

CSC 798 Research in Computer Science

Prerequisite: permission of department head. Supervised research in computer science. May be repeated, but no more than 6 hours may count toward the Master of Natural and Applied Science degree. 1-4 F,S

CSC 799 Thesis

Prerequisite: permission of instructor. Independent research and study connected with preparation of thesis. No more than 6 hours may count toward the Master of Natural and Applied Science degree. 1-6 D



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Department of Geography, Geology, and Planning

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Assistant Professor: Mario Daoust, Diane M. May, Matthew C. Pierson, Xiaomin Qiu, Jacob R. Sowers

Emeritus Professor: David A. Castillon, John C. Catau, William H. Cheek, William T. Corcoran, Stanley C. Fagerlin, Russell L. Gerlach, Elias Johnson, Vincent E. Kurtz, Erwin J. Mantei, Thomas D. Moeglin, Milton D. Rafferty

Programs

Master of Science, Geospatial Sciences in Geography and Geology

Robert T. Pavlowsky, Graduate Director

Temple Hall, Room 321; Phone (417) 836-8473

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Program Description

The program of study is designed to provide professional training and develop scholarly analytical skills in Geospatial Science with applications in one of three areas: 1) Physical Geography; 2) Human Geography and/or Planning; or 3) Geology. This program emphasizes the integration of the theoretical frameworks of Geography and Geology and Geospatial Science principles. By combining these areas, students will be able to address research problems regarding environmental issues and resource management.

The core curriculum consists of course work in Geographic Information Science (GIS), Remote Sensing, research methods and research presentations, both written and oral. Students are encouraged to develop, with their advisors, a program that fits their

individual talents and goals. The department recommends that students choose a research concentration in Physical Geography, Human Geography and/or Planning, or Geology. If a student intends to pursue research outside these concentration areas, he/she should contact the program director and prospective advisor, if possible, before applying to the program. Admission is granted to students with demonstrated academic competences who are interested in a professional career in geography or geology.

Funding for graduate students in Geospatial Sciences is available through application for competitive graduate assistantships which carry both a stipend and fee waiver. Applications for graduate assistantships should be submitted directly to the Graduate Program Director in the Department of Geography, Geology and Planning. Additional graduate assistantships may also be available through listings by other departments and offices.

Admission Requirements

The Department's Graduate Admissions Committee requests the following materials from each applicant:

1. An application for admission to the Graduate School;
2. Official transcripts from all previously attended institutions of higher education;
3. Graduate Record Examination scores;
4. Three letters of recommendation from persons familiar with the candidate's academic abilities and professional potential sent to the MS Program Director.
5. Separate application to the MS Program Director for a graduate assistantship, if desired. The application for graduate assistantship is available at the Graduate College website.

Since no specific undergraduate major is required, some students may be admitted on a conditional basis if they lack sufficient academic experience to take the required core courses. In these cases, specific undergraduate courses may be required before full admission is granted. Undergraduates interested in this program are encouraged to include courses in cartography, aerial photography interpretation, statistics, chemistry, biology and environmental science. Calculus and physics may be required for studies in some areas of geology.

Advisement

1. Each student should consult with the department's general graduate advisor before registering for the first semester of classes.
2. Each student is also encouraged to identify a general thesis topic as soon as possible. This will permit the selection of an appropriate faculty advisor who, in consultation with the student, will help to identify a second member of the student's advisory committee. The third member of this committee will be assigned by the department.
3. Once the membership of the advisory committee has been established, the student should rely upon its members, but especially the chairperson, for assistance in the selection of his/her elective courses, and for advice and direction in the thesis research.
4. Until such time as the advisory committee has been formed, the student should continue to consult with the department's graduate advisor.

Physical Geography

Students interested in physical geography can select a research topic in fluvial geomorphology, water quality and watershed management, or climatology. Students should integrate geospatial science with physical geography when doing either a thesis or non-thesis research project. Students selecting this concentration would normally take at least two of the following courses:

- [GRY 625](#) Environmental Hazards
- [GRY 635](#) Global Climate and Weather Cycles
- [GRY 645](#) Global Environmental Change

- [GRY 650](#) Fluvial Geomorphology
- [GRY 731](#) Environmental Assessment
- [GRY 751](#) Topics in Advanced Physical Geography
- [GEO 770](#) Advanced Field and Laboratory Methods

Human Geography and/or Planning

Students interested in human geography and/or planning can select a research topic in land use assessment, urban design, community and regional planning, neighborhood planning, transportation planning, or tourism planning and development. Students should integrate geospatial science with human geography and/or planning when doing either a thesis or non-thesis research project. Students selecting this concentration would normally take at least two of the following courses:

- [GRY 610](#) Applications in Sustainable Geotourism
- [GRY 625](#) Environmental Hazards
- [GRY 645](#) Global Environmental Change
- [GRY 731](#) Environmental Assessment
- [PLN 605](#) Social Planning
- [PLN 670](#) Planning Law
- [PLN 671](#) Land Use Planning
- [PLN 673](#) Urban Design and Preservation
- [PLN 674](#) Open Space Planning

Geology

Students interested in geology can select a research topic in environmental geochemistry, geohydrology, karst systems, stratigraphy, or geophysics. Students should integrate geospatial science with geology when doing either a thesis or non-thesis research project. Students selecting this concentration would normally take at least two of the following courses.

- [GLG 670](#) Principles of Stratigraphy
- [GLG 672](#) Geohydrology
- [GLG 673](#) Engineering Geology
- [GLG 680](#) Geochemistry
- [GLG 681](#) Geochemical Techniques
- [GLG 690](#) Applied Geophysics

Students interested in research topics outside of these three concentrations should consult with the Graduate Program Director and a possible advisor before beginning the program.

Degree Requirements

A minimum of 33 hrs with thesis; a minimum of 36 hours for the non-thesis option

1. Required Geospatial Sciences Core (Total 15 hours)

Course Code	Course Title	Credit Hours
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<u>GEO 700</u>	Introduction to Graduate Study in Geospatial Sciences	3 hrs
<u>GEO 701</u>	Research Methods in Geospatial Sciences	3 hrs
<u>GEO 651</u>	Remote Sensing	3 hrs
<u>GEO 661</u>	Intermediate Geographic Information Science	3 hrs
	One of the following:	3 hrs
<u>GEO 666</u>	Advanced Geographic Information Science	
<u>GEO 668</u>	Thematic Cartography	
<u>GEO 672</u>	Introduction to Photogrammetry and LiDAR Technology	
<u>GEO 673</u>	Geographic Information Science Programming	
<u>GEO 678</u>	Remote Sensing Digital Image Processing	

Students who do not have adequate background in statistical analysis from their undergraduate course work are strongly encouraged to take at least one of the following (3 hours):

[MTH 645](#) Applied Statistics

[MTH 646](#) Analysis of Variance and Design of Experiments

[MTH 647](#) Applied Regression Analysis

[MTH 648](#) Applied Time Series Analysis

2. Research Requirement (complete one).

1. **Thesis Option.** A student can take up to 3 hours of [GRY 779](#) or [GLG 779](#) plus up to 6 hours of [GRY 799](#) or [GLG 799](#). Successful completion of a thesis and thesis defense is required.
2. **Non-Thesis Option.** Students choosing the non-thesis option must complete 3 hours of [GRY 779](#) or [GLG 779](#) plus 3 hours of [GEO 780](#). Successful completion of a research project and scholarly report is required. The results of the research project must be presented orally at a departmental seminar or at a professional meeting and the student's advisor and the departmental Graduate Program Director must approve the written report on the research project. Students in the non-thesis option are not allowed to count thesis hours toward the 36 hour degree requirement.

3. **Additional Course Requirements.** Students in the thesis option must complete an additional 18 hours of graduate course work beyond the required 15-hour core. Students choosing to complete a thesis may count up to 3 credit hours of [GRY 779](#) or [GLG 779](#) and up to 6 credit hours of [GRY 799](#) or [GLG 799](#) toward this 18 hour requirement. Students in the non-thesis option must complete an additional 21 hours of graduate course work beyond the required 15 hour core. Students choosing the non-thesis option may count 3 credit hours of [GRY 779](#) or [GLG 779](#) and 3 credit hours of [GEO 780](#) toward this 21 hour requirement. Students in the thesis option must complete at least 17 credit hours of course work at the 700 level; students in the non-thesis option must complete at least 18 credit hours of course work at the 700 level. Students must complete a program of study worksheet by the end of their first academic semester. Before enrolling in the 12th hour of graduate credit, the student, an academic advisor, and the Graduate Program Director must agree upon and sign an Advisor Approved Program of Study.

Students whose undergraduate background does not include the prerequisite material for [GEO 651](#) and/or GEO 561 are required to take Introduction to Geographic Information Science for [GRY 697](#) credit. This credit does not count toward the additional 18 hours of graduate course work required for the thesis option or toward the additional 21 hours of graduate course work required for the non-thesis option.

4. **Comprehensive Examination.** A written comprehensive examination must be taken before the end of the third semester of full-time enrollment in the program. Students will be provided reading lists and/or study guides specific to their individual program of study. For students in the thesis option, the examination questions will be provided by the student's advisor and at least two other members of the student's thesis committee; for students in the non-thesis option, the examination questions will

be provided by the student's advisor and two other members of the faculty selected by the departmental Graduate Director. A student may repeat the examination, or section of the examination, upon recommendation of the Graduate Program Director and approval of the Department Head. Students who have not passed the comprehensive examination upon completion of three academic semesters of full-time study will not be permitted to continue in the program. If a student opts to change tracks after completing the comprehensive examination, the student must take and pass the examination specific to the new selected track before a degree will be awarded.

The faculty members writing the examination questions shall determine what constitutes a passing mark for the exam.

5. **Research Concentrations.** The Department of Geography, Geology and Planning has identified three areas of research concentration for prospective students. Students are strongly encouraged to select a research topic in one of these concentration areas.

Accelerated Master's Degree Option

Eligible Missouri State University undergraduate majors in Geography, Geospatial Sciences, Geology, and Planning may apply for early admission to the Master of Science in Geospatial Sciences. Once accepted for early admission, students will be able to take up to 12 credit hours that apply to both their undergraduate and graduate program. This option allows students with advanced course work in Geography, Geospatial Sciences, Geology, or Planning to complete a masters degree in three full semesters and one summer semester. Students can choose from [GEO 651](#), [GEO 666](#), [GEO 668](#), [GLG 690](#), [GLG 672](#), [GLG 673](#), [GLG 680](#). Contact the Department of Geography, Geology and Planning for further information and guidelines.

Before enrolling in courses to be counted for both undergraduate and graduate credit, an undergraduate student must be accepted into the accelerated masters program AND receive prior approval from the Graduate Program Director, Department Head of the undergraduate program and the Graduate College Dean (on a Mixed Credit Form). Acceptance to the program and all approvals must be completed prior to the end of change of schedule period for the course(s). See the Graduate College for further information.

Admission Requirements

- 1. Junior standing, majoring in Geography, Geospatial Sciences, Geology or Planning with an overall GPA of 3.25 or better.
- 2. Majors in Geology must have completed GLG 333 and have a GPA of 3.25 in all Geology courses. Majors in Geography and Geospatial Sciences must have completed GEO 561 and have a GPA of 3.25 in all geography and geospatial sciences courses.
- 3. Acceptance of applicant by a graduate faculty member who agrees to serve as the student's graduate research advisor.
- 4. Acceptance of applicant by the graduate faculty in Geography, Geology and Planning under the accelerated master's option.

Master of Science, Administrative Studies: Environmental Management Option

The Department of Geography, Geology and Planning participates in the Master of Science, Administrative Studies (MSAS) degree. The MSAS is an interdisciplinary program composed of courses from departments and colleges across campus. The program, which includes a significant online component, is administered by a faculty committee and located in the Graduate College. [See more information on the MSAS.](#)

Requirements

Course Code	Course Title	Credit Hours
GRY 731	Environmental Assessment	3 hrs
ECO 640	Economics of the Environment	3 hrs
Elective Hours (6 hours chosen from following in consultation with advisor)		

<u>BIO 632</u>	Principles of Fisheries Management	3 hrs
<u>BIO 662</u>	Limnology	3 hrs
<u>BIO 689</u>	Game Management	3 hrs
<u>BIO 726</u>	Advanced Limnology Methods	3 hrs
<u>CHM 760</u>	Chemistry of Environmental Systems	3 hrs
<u>PLN 671</u>	Land Use Planning	3 hrs
<u>PLN 674</u>	Open Space Planning	3 hrs
<u>GRY 748</u>	Physiography & Resource Conservation	3 hrs
<u>PLN 670</u>	Planning Law	3 hrs

Master of Natural and Applied Science

[See separate program listing under the "College of Natural and Applied Sciences".](#) Accelerated masters opportunity available.

Master of Science in Education, Secondary Education: Earth Science Area of Emphasis

Contact Dr. Melida Gutierrez and [see program requirements for the M.S.Ed., Secondary Education under Interdisciplinary Graduate Programs.](#)

Prerequisite Earth Science Requirements

A minimum of 24 hours in Science and/or Mathematics.

Earth Science Requirements

[GLG 701](#) Geology for Secondary Teachers I 3 hrs

[GLG 702](#) Geology for Secondary Teachers II 3 hrs

Additional Geography and Geology course work 9 hrs

Total 15 hrs

Master of Science in Education, Secondary Education: Geography Area of Emphasis

Contact Dr. Judith Meyer and [see program requirements for the M.S.Ed., Secondary Education under Interdisciplinary Graduate Programs.](#)

Prerequisite Geography Requirements

A minimum of 24 hours in the social sciences including Economics, Geography, History, Political Science, Psychology, and Sociology.

Geography Requirements

[GRY 700](#) Cultural Geography for Secondary Teachers I 3 hrs

[GRY 703](#) Cultural Geography for Secondary Teachers II 3 hrs

Additional Geography course work 9 hrs

Total 15 hrs

Master of Science in Education, Secondary Education: Natural Science Area of Emphasis

Contact Dr. Tamera Jahnke and [see program requirements for the M.S.Ed., Secondary Education under Interdisciplinary Graduate Programs.](#)

Natural Science Prerequisite and Requirements

In this option, students complete a minimum of 15 hours with course work selected from two of the following disciplines: Biology, Chemistry, Geography and/or Geology, Mathematics, and Physics. A minimum of 3 hours of course work numbered 700 or above must be included. The prerequisite requirements are those listed in the departmental statements of both selected academic areas of emphasis.

Courses from one of the above disciplines	9 hrs
Courses from a second of the above disciplines	6 hrs
Total	15 hrs

Geospatial Information Sciences Graduate Certificate

Program Description

This certificate program is designed to provide graduate-level education in Geospatial Sciences including such focus areas as Geographic Information Systems, Internet Mapping, Military and Intelligence Applications, and Remote Sensing. It is anticipated that this program would be attractive to working professionals in such organizations as the United States Geological Survey, the National Geospatial-Intelligence Agency, and the United States Army and Army Corps of Engineers. This certificate is being offered jointly by the Geological Engineering degree program in the Department of Geological Sciences and Engineering within the School of Materials, Energy and Earth Resources at the Missouri University of Science and Technology (MS&T) and the Department of Geography, Geology and Planning at Missouri State University. Faculty members from MS&T and Missouri State will jointly organize, administer and offer the graduate certificate as described below.

This certificate uniquely utilizes the complementary expertise at the MS&T and Missouri State to provide a wide range of courses and topic areas so that students can customize their program of study and focus on particular interests.

Completion Requirements

Students must have an overall grade point average of 3.00 for completion of the certificate program.

Curriculum (12 hours total)

It is anticipated that a student will typically complete two courses from those offered by MS&T and two courses from those offered by Missouri State. Courses will be offered both at off-campus locations (such as at a USGS or NGA facility) and at the respective campuses. Some courses will be available as on-line distance offerings in the future. Each university has appointed a program technical coordinator who will serve as primary academic advisor and liaison for student in the program. Courses should be selected in consultation with and approved by these program coordinators to insure proper prerequisites are satisfied and that duplication is avoided. A summary of courses tentatively planned to be offered is listed below.

MS&T courses:

- GE 315 Statistical Methods in Environmental Geology and Engineering
- GE 342 Military Geology
- GE 344 Remote Sensing Technology

- GE 346 Applications of Geographic Information Systems
- GE 446 Advanced Remote Sensing and Image Processing

Missouri State courses:

- [GEO 651](#) Remote Sensing
- [GEO 661](#) Intermediate Geographic Information Science
- [GEO 662](#) Internet Geospatial Science
- [GEO 666](#) Advanced Geographic Information Sciences
- [GEO 673](#) Geographic Information Science Programming
- [GEO 678](#) Remote Sensing Digital Image Processing

Other courses approved by the MS&T and Missouri State faculty may be substituted for any of the above listed courses on a case-by-case basis. The certificate program technical coordinators must approve the substitution prior to enrolling in any course.

Admission Criteria

The Geospatial Information Sciences Certificate program is open to all persons holding a B.S., B.A., M.S., or Ph.D. degree. Students must, of course, satisfy all prerequisites for any courses they take in the program; or they must obtain instructor approval to waive any prerequisites. Once admitted to the program, the student must take a minimum of four courses as designated and approved by the program director and must have an average cumulative grade point average of 3.00 or better to receive the certificate.

Students who complete the four-course requirements for the certificate with a grade of B or better in each course may be admitted directly to the respective M.S. program in each institution if they so choose. This admission does not waive the necessity for students to take required prerequisites for other required courses that are part of the M.S. program. The certificate credits taken will count toward the requirement for their M.S. degree.

Geology Courses

GLG 623 Coastal Marine Geology

Prerequisite: permission; and concurrent enrollment in GLG 624. A study of inshore and nearshore geologic processes, sedimentation patterns and landform development. Must be taken at Gulf Coast Research Laboratory, Ocean Springs, Mississippi. May be taught concurrently with GLG 523. Cannot receive credit for both GLG 523 and GLG 623. 2(2-0) Su

GLG 624 Coastal Marine Geology Lab

Prerequisite: concurrent enrollment in GLG 623. Laboratory portion of GLG 623. Field and laboratory activities. Must be taken at Gulf Coast Research Laboratory, Ocean Springs, Mississippi. May be taught concurrently with GLG 524. Cannot receive credit for both GLG 524 and GLG 624. 1(0-2) Su

GLG 630 Optical Mineralogy

Recommended Prerequisite: GLG 333. Essentials of optical crystallography; the use of the petrographic microscope in the identification of rock-forming minerals, both in oil-immersion grain mounts and in thin sections. May be taught concurrently with GLG 530. Cannot receive credit for both GLG 530 and GLG 630. 3(1-4) D

GLG 640 X-Ray Mineralogy

Recommended Prerequisite: GLG 332. Principles and techniques of x-ray mineralogy; the use of x-ray powder diffraction in the

identification and characterization of minerals and related crystalline phases. May be taught concurrently with GLG 540. Cannot receive credit for both GLG 540 and GLG 640. 3(1-4), D

GLG 670 Principles of Stratigraphy

Recommended Prerequisite: GLG 314 and GLG 333. Principles underlying the deposition of sediments; environmental control of lithofacies and biofacies; recognition of ancient depositional environments by key indicators and modern analogs. May be taught concurrently with GLG 570. Cannot receive credit for both GLG 570 and GLG 670. 4(3-2) F

GLG 672 Geohydrology

Recommended Prerequisite: GLG 314; and either MTH 261 or MTH 287. Aquifer properties; elementary theory of groundwater flow through a porous medium; well and aquifer relationships. Laboratories include ground-water case studies and Hydrologic Investigation Atlas interpretations. Field trips required. Taught concurrently with GLG 572. Cannot receive credit for both GLG 572 and GLG 672. 3(2-2) S

GLG 673 Engineering Geology

Recommended Prerequisite: GLG 333. Engineering properties of rocks and soils; fundamentals of engineering geology field investigations; application of properties and fundamentals to engineering problems concerning slope stability, groundwater, industrial contamination, urban public works, and karst areas. Laboratories include engineering classification of soils, hydraulic conductivity testing, and public works design and management. Field trip to observe engineering problems of karst required. May be taught concurrently with GLG 573. Cannot receive credit for both GLG 673 and GLG 573. 3(2-2) SE

GLG 674 Petroleum Geology

Recommended Prerequisite: GLG 314 and GLG 333 and GLG 570. Origin of hydrocarbons in sedimentary successions; petroleum systems, sequence stratigraphic concepts; basin analysis; petroleum exploration techniques, including well log and seismic interpretation; techniques for resource exploitation and an introduction to petroleum production. May be taught concurrently with GLG 574. Cannot receive credit for both GLG 674 and GLG 574. 3(2-2) S

GLG 680 Geochemistry

Recommended Prerequisite: GLG 332. Topics include the dominant chemical reactions in natural waters, equilibrium conditions between mineral precipitation and dissolution, and characteristics of contaminated groundwater. Field trips required. Taught concurrently with GLG 580. Cannot receive credit for both GLG 580 and GLG 680. 3(2-2) F

GLG 681 Geochemical Techniques

Recommended Prerequisite: GLG 332. Geochemical techniques and procedures used in ore exploration, point and nonpoint contamination and other environmental studies. Analyses of trace elements in rocks, soils, plants and waters using inductively coupled plasma methods. Also use of GPS to locate sample sites and ArcView to prepare maps. Field trips required. May be taught concurrently with GLG 581. Cannot receive credit for both GLG 581 and GLG 681. 4(2-4) SO

GLG 690 Applied Geophysics

Recommended Prerequisite: GLG 340; and either PHY 124 or PHY 204; and either MTH 280 or MTH 288. Application of geophysical methods in solving geologic problems. Techniques covered include seismic refraction and reflection, gravity, magnetics, direct current and electromagnetic resistivity. Field trips required. May be taught concurrently with GLG 590. Cannot receive credit for both GLG 590 and GLG 690. 3(2-2) S

GLG 694 Global Tectonics

Recommended Prerequisite: GLG 314. The fundamental basis of plate tectonics. Topics covered include geophysical methods, plate motion theory, fundamental properties of plate boundaries, formation of sedimentary basins and orogenic belts. May be taught concurrently with GLG 594. Cannot receive credit for both GLG 694 and GLG 594. 3(3-0) S

GLG 697 Selected Topics in Geology

Prerequisite: permission. Detailed treatment of various advanced topics in geology which may vary from year to year. Some typical topics: geologic instrumentation, selenology, sedimentology, and crystallography. Variable content course. May be repeated for a total of 6 hours. May be taught concurrently with GLG 597. Cannot receive credit for both GLG 597 and GLG 697. 1-5, D

GLG 701 Geology for Secondary Teachers I

Prerequisite: permission. Earth materials, geological processes, geological history and the geological environments. 3(2-2) D

GLG 702 Geology for Secondary Teachers II

Prerequisite: GLG 701. Continuation of GLG 701. 3(2-2) D

GLG 713 Field Geology for Secondary Teachers

Prerequisite: permission. Field work; identification and correlation of rock units; determination of depositional environments from fossils and other indicators. Students are required to make a collection of specimens from rock formations in the study area. May be repeated to a total of 6 hours when destination varies. Supplemental course fee. 1-3 D

GLG 751 Seminar in Geology

Prerequisite: permission. Preparation of an extensive paper on selected topics to be read before staff seminars. 2(2-0) D

GLG 765 Selected Topics in Earth Science

Prerequisite: permission. Students cooperatively select from general subject areas in earth science more specific areas to explore. Topics are studied consecutively during the semester. Subject areas from which the topic selections are made are included in the class schedule for each term the course is offered. Variable content course. Since topics vary, the course may be repeated for a total of 6 hours. Identical to GRY 740. Cannot receive credit for more than 6 hours of GLG 755 and GRY 740 combined. 1-3 D

GLG 779 Research/Geological Sciences

Prerequisite: permission. Original research supervised by the geology staff, involving special areas of the geological sciences. May be repeated to a total of 3 hours. 1-3 D

GLG 796 Science Internship

Completion of an internship project (80 hours/credit hour) at a discipline-related business, nonprofit organization, or government agency, approved and supervised by both the departmental and internship advisors. Includes a formal report in the appropriate professional format, and an oral presentation at an approved venue. Graded Pass/Not Pass only. No more than 6 hours may count toward a masters degree. 1-6 F,S,Su

GLG 799 Thesis

Prerequisite: permission. Independent research and study connected with preparation of thesis. 1-6 D

Geography Courses

GRY 607 Geography of Subsaharan Africa

An in-depth geographic study of Africa south of the Sahara Desert. Surveys physical and political geography, climate, tribalism, religion, demography, natural resources, transportation, industry and economic activities of African states South of the Sahara. Students are required to complete two research projects. May be taught concurrently with GRY 507. Cannot receive credit for both GRY 507 and GRY 607. 3(3-0) D

GRY 610 Applications in Sustainable Geotourism

Recommended Prerequisite: GRY 410. This course will explore environmentally and socially responsible tourism strategies and innovations, and provide tools needed by private and public tourism entities to work together. The principles of Geotourism will be applied in a practicum to a local, regional or national community. Students will work as a team and individually to develop a tourism policy and plan based on Geotourism parameters. May be taught concurrently with GRY 510. Cannot receive credit for both GRY 610 and GRY 510. 3(3-0) S

GRY 625 Environmental Hazards

Recommended Prerequisite: GRY 142; or both GRY 135 and GLG 110. Identification, recognition, and impact of hazards. Physical exposure to hazards and human vulnerability in LDCs and MDCs. Disaster trends and patterns. Behavioral and structural paradigms of hazards. EM-DAT: international disaster database. Statistical methods used in risk assessments. Risk perception, communication, and disaster management. Tectonic, mass movement, atmospheric, hydrological, biophysical, and technological hazards: analysis, preparedness, and mitigation. May be taught concurrently with GRY 525. Cannot receive credit for both GRY 525 and GRY 625. 3(3-0) S

GRY 635 Global Climate and Weather Cycles

Recommended Prerequisite: GRY 135; and MTH 340 or AGR 330 or ECO 308 or PSY 200 or QBA 237 or REC 328 or SOC 302. Energy and mass exchanges. Global atmospheric circulation; surface and upper-air flows. Index cycle: zonal and meridional atmospheric circulations. Teleconnections and atmospheric oscillations: NAO, PNA, PDO, AO, ENSO, and AMO. Interactions between atmospheric oscillations and surface climatic variables in the United States and around the world. Weather cycles, natural climatic variability and climate change. Drought indices. Spatial and temporal statistical domains used in climatic data analysis. May be taught concurrently with GRY 535. Cannot receive credit for both GRY 535 and GRY 635. 3(3-0) D

GRY 645 Global Environmental Change

Recommended Prerequisite: GRY 142 or both GRY 135 and GLG 110. Energy and mass fluxes and storages in the interlinked physical components of the ecosphere. Chemistry of the global atmosphere. Role of the oceans and thermohaline circulation. Land use and land cover influences on terrestrial ecosystems. Concepts of environmental cycles, thresholds, resilience, recovery and response times. Understanding past environmental changes. Causes, mechanisms and likely impacts of natural and anthropogenically-induced changes on the global environment. Predictive models on global environmental change. May be taught concurrently with GRY 545. Cannot receive credit for both GRY 545 and GRY 645. 3(2-2) D

GRY 650 Fluvial Geomorphology

Study of the formation, composition, distribution of fluvial landforms. Emphasis is on channel hydrology, quantification of geomorphic relationships, reach and watershed-scale processes, sediment transport, water and sediment contamination, and management applications to streams in the Ozarks Region as well as other places. Field work may be required. May be taught concurrently with GRY 550. Cannot receive credit for both GRY 550 and GRY 650. 3(3-0) S

GRY 696 Topical Issues in Education

Prerequisite: permission. Selected topics in geography and earth science to upgrade understandings and skills in improvement of elementary or secondary teaching. Each course is concerned with a single topic or subject matter area. Number of class hours determined by semester hours of credit. Variable content course. May be repeated to a total of 5 hours credit. May be taught

concurrently with GRY 596. Cannot receive credit for both GRY 596 and GRY 696. 1-5 D

GRY 697 Special Topics in Geography

Prerequisite: permission. Selected topics in geography. Special topics will be included in the class schedule for each term. Field trips may be required. Number of class hours determined by semester hours of credit. Variable content course. May be repeated to a maximum of 6 hours credit. May be taught concurrently with GRY 597. Cannot receive credit for both GRY 597 and GRY 697. 1-5 D

GRY 698 Research in Geography

Prerequisite: permission. Enrichment through guided but independent, original research in geography and geography related subject areas. May be repeated for a total of 6 credit hours. 1-3 F,S

GRY 700 Cultural Geography for Secondary Teachers I

Population and the spatial imprint of man on the landscape in terms of settlement, economic activities, institutions; methods and materials of the high school geography project; other current curriculum materials. 3(2-2) D

GRY 703 Cultural Geography for Secondary Teachers II

Prerequisite: GRY 700. Continuation of GRY 700. Contemporary problems in land use, urbanization and planning for optimum use of resources; methods and materials of the high school geography project; other current curriculum materials. 3(2-2) D

GRY 730 Weather Elements for Secondary Teachers

Physical processes of the earth's atmosphere, use of weather instruments and interpretation of weather maps. Applied aspects of weather and climate and their effects on man's activities. Emphasis on current curriculum materials for secondary schools. 3(3-0) D

GRY 731 Environmental Assessment

The procedures and processes of environmental assessment. Soils, hydrology, climate, biogeography and geomorphology will be examined in an environmental assessment context. Environmental assessment is a prerequisite for satisfying the National Environmental Policy Act (NEPA) requirements. 3(2-2) S

GRY 740 Selected Topics in Earth Science

Prerequisite: permission of instructor. Students cooperatively select from general subject areas in earth science more specific areas to explore. Topics are studied consecutively during the semester. Subject areas from which the topic selections will be made are included in the class schedule for each term the course is offered. Variable content course. Since topics vary, the course may be repeated for a total of 6 hours. Identical with GLG 765. Cannot receive credit for more than 6 hours of GRY 740 and GLG 765. 1-3 D

GRY 748 Physiography and Resource Conservation

Landforms, economic minerals, soils, climate, water resources and closely related aspects of the natural environment as they relate to man's inhabitation and use of the earth; map reading and simple map construction; methods and materials for secondary schools. 3(2-2) D

GRY 751 Topics in Advanced Physical Geography

Critical review of recent advances and trends in applied and/or theoretical physical geography. Course will involve the study of seminal and recent journal articles and presentation of a research paper. Course content may vary among the subfields of physical geography including geomorphology, hydrology, water resources, soil geography climatology, and biogeography. Field trips may be required. 3(3-0) D

GRY 779 Research in Geography

Prerequisite: permission. Enrichment through guided but independent, original research in geography and geography related subject areas. May be repeated for a total of 3 credit hours. 1-3 D

GRY 799 Thesis

Prerequisite: permission. Independent research and study connected with preparation of thesis. 1-6 F,S

Geospatial Courses

GEO 651 Remote Sensing

Recommended Prerequisite: GRY 360. Introduction to environmental studies through the application of remotely sensed imagery and geospatial technologies. The course covers principles of remote sensing, interactions of electromagnetic energy with the atmosphere and earth's surface, satellite systems and sensors (electro-optical, thermal, radar and LiDAR). Emphasis is placed on regional and global monitoring, land cover mapping, forestry, agriculture, geology, planning and oceanography. Laboratory emphasizes interpretation of remotely sensed imagery and introduction to digital image processing including enhancements, corrections and classification routines. May be taught concurrently with GEO 551. Cannot receive credit for both GEO 551 and GEO 651. 3(2-2) S

GEO 661 Intermediate Geographic Information Science

Recommended Prerequisite: GRY 363. Principles and applications of Geographic Information Systems (GIS) software. Examines the nature and accuracy of spatially referenced data, as well as methods of data capture, storage, retrieval, visualization and output. May be taught concurrently with GEO 561. Cannot receive credit for both GEO 561 and GEO 661. 3(2-2) S

GEO 662 Internet Geospatial Science

Recommended Prerequisite: GEO 561 or GEO 661. Basic understanding of the contemporary standards for using the Internet to distribute and utilize geospatial data. Students will develop and implement both single or multiple source geospatial portals. A major part of the course will examine user interaction design for geospatial data in both a wired and wireless environment. May be taught concurrently with GEO 562. Cannot receive credit for both GEO 562 and GEO 662. 3(2-2) F

GEO 666 Advanced Geographic Information Science

Recommended Prerequisite: GEO 561 or GEO 661. A theoretical and practical examination of analytical methods use in GIS, including vector and raster models, spatial overlay, incorporation of field data, analysis of surfaces, interpolation, TINs and network analysis. May be taught concurrently with GEO 566. Cannot receive credit for both GEO 566 and GEO 666. 3(2-2) F

GEO 668 Thematic Cartography

Recommended Prerequisite: GEO 561 or GEO 661. Theoretical and applied aspects of map design in thematic mapping, animated mapping, interactive and web mapping. Emphasis will be applying computer-assisted mapping techniques of the problems of effective and efficient communication of spatial data. Field trip is required. May be taught concurrently with GEO 568. Cannot receive credit for both GEO 668 and GEO 568. 3(2-2) F

GEO 672 Introduction to Photogrammetry and LiDAR Technology

Recommended Prerequisite: GRY 360. Course covers basic concepts of photogrammetry and LiDAR techniques such as stereo feature extraction, orthophoto, LiDAR point cloud visualization and DEM/DTM generation. Laboratory emphasizes geospatial stereo feature extraction using digital photogrammetry software, ArcGIS and Matlab toolboxes. May be taught concurrently with GEO 572. Cannot receive credit for both GEO 572 and GEO 672. 3(1-4) S

GEO 673 Geographic Information Science Programming

Recommended Prerequisite: GEO 561 or GEO 661, and either CIS 202 or CSC 121 or CSC 125. Course devoted to theories and processes of analytical and automated Geographic Information Science (GIS). Principal topics covered are spatial programming, geographic data storage, computer map rendering, application customization and automation and human interface development of GIS. Advanced GIS and programming skills for professional development are emphasized. May be taught concurrently with GEO 573. Cannot receive credit for both GEO 573 and GEO 673. 3(2-2) F

GEO 675 GPS Surveying and Mapping

Theory and operation of global positioning systems (GPS) hardware and software. Including mission planning, measurement of point, line and area features, differential correction techniques and waypoint navigation. Field exercises required. May be taught concurrently with GEO 575. Cannot receive credit for both GEO 575 and GEO 675. 3(1-4) S

GEO 678 Remote Sensing Digital Image Processing

Prerequisite: GEO 551 or GEO 651 or GEO 566 or GEO 666 or GEO 572 or GEO 672. Advanced application of remote sensing digital image processing in areas of interest such as land use/land cover mapping, agriculture, forestry, resource planning and geology. Course covers image visualization, image correction, classification algorithms and change detection methods. Laboratory emphasizes advanced image processing techniques using ENVI software. May be taught concurrently with GEO 578. Cannot receive credit for both GEO 578 and GEO 678. 3(2-2) F

GEO 700 Introduction to Graduate Study in Geospatial Science

Orientation to graduate study in geospatial sciences and development of a research proposal. 3(3-0) F

GEO 701 Research Methods in Geospatial Science

Prerequisite: GEO 700. Methods of collecting, organization, and analyzing data pertinent to graduate study in Geospatial Science. Emphasis will be on the application of univariate and multivariate statistical techniques and other quantitative techniques pertinent to mathematically and statistically modeling geospatial problems. 3(2-2) S

GEO 755 Applications of Digital Cartography, Analytical Photogrammetry, and Remote Sensing

Prerequisite: permission. Advanced application of aerial photography and digital imagery, analytical photogrammetry, remote sensing, digital cartography and other geospatial technologies in areas of interest such as land use/land cover mapping, landscape ecology, agriculture, forestry, resource planning, geology, and soils. Since credit and topics vary, the course may be repeated for a maximum of 7 hours with permission. 1-3 D

GEO 770 Advanced Field and Laboratory Methods

Advanced training in laboratory and field methods in geography and geology. Topics will vary due to faculty expertise or student interest. Examples include watershed monitoring techniques, geochemical techniques, and field studies in remote areas. Field trips are required. 3(1-4) D

GEO 780 Research Paper in Geospatial Sciences

Prerequisite: permission. Extensive research paper on selected topic to be presented orally at a departmental seminar or professional meeting. Exclusively used to satisfy requirements for non-thesis option. 3 D

Planning Courses

PLN 605 Social Planning

This course will address planning practice in relation to values of justice, equity, fairness, and efficiency. In particular the course will focus upon inclusion of different community groups within the planning decision making process. A field project is required. May be taught concurrently with PLN 505. Cannot receive credit for both PLN 605 and PLN 505. 3(3-0) S

PLN 670 Planning Law

Study of the legal foundations of land use controls. Topics include historic legal cases establishing government intervention in private development zoning, subdivision, growth management, individual liberty, environmental regulation and the general welfare concept. May be taught concurrently with PLN 570. Cannot receive credit for both PLN 570 and PLN 670. 3(3-0) S

PLN 671 Land Use Planning

Recommended Prerequisite: PLN 271 or PLN 372 or FIN 266. Focuses on conceptual and analytical techniques of land use planning, including land use analysis, planning studies and procedures, and synthesis of planning elements through comprehensive plan development. May be taught concurrently with PLN 571. Cannot receive credit for both PLN 571 and PLN 671. 3(3-0) F

PLN 672 Community Planning Practicum

Prerequisite: PLN 571 or PLN 671. Focuses on the process of plan preparation and is intended to provide experience in the application of planning principles and analytical techniques learned in other program courses to an actual planning problem. Students will work on an individual basis and as part of a team in preparing a final report. Field problems will vary. May be taught concurrently with PLN 572. Cannot receive credit for both PLN 572 and PLN 672. 4(3-2) S

PLN 673 Urban Design and Preservation

Recommended Prerequisite: PLN 271 and GRY 322. Elements of urban design and preservation in relation to social, economic, and political forces; the role of the urban designer in the planning process. May be taught concurrently with PLN 573. Cannot receive credit for both PLN 573 and PLN 673. 3(3-0) S

PLN 674 Open Space Planning

Principles and methods of open space planning. Students will learn about the relationship between open space and the quality of life in cities and will obtain a foundation for conducting open space planning projects. Class format includes lecture, seminar and studio. Field problem required. May be taught concurrently with PLN 574. Cannot receive credit for both PLN 574 and PLN 674. 3(2-2) S

PLN 676 Site Planning Studio

Recommended Prerequisite: PLN 271 and PLN 372. Lecture-studio focusing on the principles and processes of urban design and site specific design requirements. Students will design site plans for specific uses such as subdivisions, shopping centers and parks for public presentation. May be taught concurrently with PLN 576. Cannot receive credit for both PLN 576 and PLN 676. 4(2-4) F

PLN 696 Research in Planning

Prerequisite: permission. Enrichment through guided but independent, original research in planning and planning related subject areas. May be repeated to a total of 6 credit hours. May be taught concurrently with PLN 596. Cannot receive credit for both PLN 596 and PLN 696. 1-3, F,S

PLN 697 Selected Topics in Planning

Detailed treatment of various advanced topics in planning which may vary from semester to semester. Some typical topics: Economic Development Planning, Rural and Small Town Planning, Housing in America. Variable content course. May be repeated to a total of 6 hours. May be taught concurrently with PLN 597. Cannot receive credit for both PLN 597 and PLN 697. 1-5 D

PLN 699 Internship in Urban and Regional Planning

Recommended Prerequisite: PLN 571. Work in community or regional planning agency. Students are monitored by Planning faculty and supervisory personnel of the planning agency. May be repeated to a total of 6 hours. May be taught concurrently with PLN 599. Cannot receive credit for both PLN 599 and PLN 699. 1-3 F,S

PLN 704 Community Resource Planning

Explanation of community growth and change. Review of public and private agency programs. Topics may focus on small towns and rural areas as well as urban and metropolitan areas. Since credit and topics vary, the course may be repeated for a maximum of 7 hours with permission. 1-3 D



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Graduate College
2012-13 Graduate Catalog

First Edition
published July 2012

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Hospitality and Restaurant Administration

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Email: HRA@MissouriState.edu

Website: <http://www.missouristate.edu/hra/>

Department Head: Melissa Dallas

Faculty

Professor: Melissa Dallas, Carl D. Riegel

Assistant Professor: Stephanie G. Hein

No master's program is offered in the Philosophy Department. However, the following courses may be taken for graduate credit by students admitted to graduate study at Missouri State University.

Hospitality and Restaurant Administration Courses

HRA 710 Risk Management and Legal Compliance in the Hospitality Industry

Prerequisite: LAW 600 or equivalent. In-depth studies of legal issues pertinent to hospitality and tourism firms are the focus of this course. Topical areas include contracts, negligence, and employment, labor, and real estate law. Treaties and international law affecting global trade policy as well as international tourism development receive heavy emphasis. 3(3-0) D

HRA 720 Hospitality Change Management and Leadership

Prerequisite: MGT 600 or equivalent. An in-depth investigation of the principles and theories of leading change in hospitality organizations. The processes, skills, and abilities needed to manage change in the industry are stressed. Attention is given to areas hospitality leaders need to address when initiating change such as vision development, team development and motivation, power and influence, performance standards, productivity, and organizational culture. Case studies will be used extensively to address course content. 3(3-0) F

HRA 730 Seminar in Hospitality and Tourism

Prerequisite: 18 graduate hours in business administration and economics. An evaluation and analysis of the theory, research, and

practice involved in hospitality and tourism fields. The course involves an integrative learning experience where students will have the opportunity to engage in an applied research project. 3(3-0) S



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Graduate College
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First Edition
published July 2012

[Missouri State](#) > [Graduate College](#) > [Graduate Catalog](#) > [College of Natural and Applied Sciences](#) > Department of Mathematics

Department of Mathematics

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Email: Mathematics@missouristate.edu

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Department Head: William O. Bray

Faculty

Distinguished Professor: Paula A. Kemp

Professor: Richard G. Belshoff, Yungchen Cheng, Kanghui Guo, Shouchuan Hu, J. Kurt Killion, Shelby J. Kilmer, George Mathew, Lynda S. Plymate, Gay A. Ragan, Jorge Rebaza, Les Reid, Kishor Shah, Clayton C. Sherman, Vera B. Stanojevic, Yingcai Su, Xingping Sun, Cameron Wickham

Associate Professor: Mark W. Rogers

Associate Professor: Matthew Wright, Songfeng Zheng

Emeritus Professor: Earl E. Bilyeu, James R. Downing, Frank S. Gillespie, Shirley M. Huffman, John D. Kubicek, David B. Lehmann, E. Rebecca Matthews, Neil C. Pamperien, Clyde A. Paul, Woodrow Sun, William Sutherlin, Joe L. Wise, Xiang Ming Yu, Liang-Cheng Zhang

Programs

Master of Science, Mathematics

Entrance Requirements

Students seeking admission to the Master of Science program in mathematics must meet the general Graduate College requirements for admission as degree-seeking students. In addition, students must have the following.

1. Students must have credit for MTH 503 Advanced Calculus; MTH 532 Abstract Algebra; MTH 533 Linear Algebra; MTH 540 Statistical Theory I, or equivalent courses.
2. Students must have a GPA, in upper division mathematics courses beyond the first calculus sequence, of 3.00 or higher on a 4.00 scale.

Students who do not meet conditions 1 and 2 above may be admitted conditionally. Deficiencies must be made up with B grades or above in courses approved by the mathematics department. Credit in such courses will not count toward the total hours required for the Master of Science in mathematics.

Degree Requirements (minimum of 32 hours)

1. A minimum of 18 semester hours of 700 level mathematics courses (except MTH 796). At least one of the following four courses must be completed:

[MTH 702](#) Real and Abstract Analysis

[MTH 732](#) Abstract Algebra II

[MTH 722](#) Theory of Ordinary Differential Equat. II

[MTH 742](#) Statistical Inference II

Students planning to continue to a Ph.D. degree are strongly advised to take the analysis and algebra sequences.

2. **Mathematics Electives.** From 4 to 15 elective hours in mathematics, dependent upon hours of research and other electives.
3. **Related Electives.** A maximum of 6 hours of elective courses in fields related to mathematics may be taken with the approval of the student's advisor.
4. **Research Requirements.** 1-6 semester hours of course work from [MTH 791](#), [792](#), [798](#), or [799](#), but a maximum of 6 semester hours may be applied toward the requirement for the M.S. degree. This requirement will be met in one of the following ways:
 1. *Option I:* Completion of a satisfactory thesis in the candidate's discipline. Thesis credit shall be no more than 6 semester hours of the minimum 32 hours required for a master's degree.
 2. *Option II:* Completion of a minimum of two seminars, each of which shall require an extensive paper or major creative work.
5. **Comprehensive Examination.** A comprehensive examination must be passed by the candidate before a degree will be granted.

Accelerated Master's Option

The Accelerated Master's Program option in Mathematics provides an opportunity for outstanding undergraduate students to begin their graduate course work during their senior year. To be eligible to apply for admission to this program, the student must have completed at least three of the courses MTH 503, MTH 532, MTH 533 and MTH 540; have a GPA of 3.5 or higher in all mathematics courses numbered MTH 261 or higher. An eligible student may apply for admission during the second semester of the junior year.

If accepted into the accelerated program, up to a maximum of 6 hours of 600/700 level mathematics courses taken after admission into the program may be given credit for both undergraduate and graduate programs. The courses [MTH 603](#), [MTH 631](#), [MTH 633](#), and [MTH 640](#) will not be given credit in the graduate program.

A student is fully admitted to the Graduate College upon completion of the requirements for the baccalaureate degree. All requirements for the master's program should be met for graduation from the master's program.

Before enrolling in a course to be counted as both undergraduate and graduate credit and to count the course toward the masters degree, an undergraduate student must be accepted into the accelerated program and receive prior approval from the graduate program advisor, department head of the undergraduate program, and the dean of the Graduate college. Acceptance into the program and all approvals must be completed prior to the end of the Change of Schedule Period for the course(s). See the Graduate College for further information.

Master of Natural and Applied Science

[See separate program listing under the College of Natural and Applied Sciences. Accelerated masters opportunity available.](#)

Master of Science in Education, Secondary Education: Mathematics Area of Emphasis

Contact Dr. Lynda Plymate and [see program requirements for the M.S.Ed., Secondary Education under Interdisciplinary Graduate Programs](#).

Prerequisite Mathematics Requirements

MTH 315 or equivalent; and MTH 302 or equivalent.

Mathematics Requirements

Mathematics courses selected with a minimum of 3 hours in courses numbered 700 or above to **total 15 hours**

Accelerated Master's Option

The Accelerated Master's Program option in Secondary Education, Mathematics provides an opportunity for outstanding undergraduate students to begin their graduate course work during their senior year. To be eligible to apply for admission to this program, the student must have completed MTH 460, MTH 532 and MTH 533; and have a GPA of 3.5 or higher in all mathematics courses numbered MTH 261 or higher. An eligible student may apply for admission during the second semester of the junior year.

If accepted into the accelerated program, up to a maximum of 6 hours of coursework from among [MTH 603](#), [MTH 636](#), [MTH 640](#) and [MTH 667](#) taken after admission into the program may be given credit for both undergraduate and graduate programs. A student is fully admitted to the Graduate College upon completion of the requirements for the baccalaureate degree. All requirements for the master's program should be met for graduation from the master's program.

Before enrolling in a course to be counted as both undergraduate and graduate credit and to count the course toward the masters degree, an undergraduate student must be accepted into the accelerated program and receive prior approval from the graduate program advisor, department head of the undergraduate program, and the dean of the Graduate college. Acceptance into the program and all approvals must be completed prior to the end of the Change of Schedule Period for the course(s). See the Graduate College for further information.

Master of Science in Education, Secondary Education: Natural Science Area of Emphasis

Contact Dr. Tamera Jahnke and [see program requirements for the M.S.Ed., Secondary Education under Interdisciplinary Graduate Programs](#).

Natural Science Prerequisite and Requirements

In this option, students complete a minimum of 15 hours with course work selected from two of the following disciplines: Biology, Chemistry, Geography and/or Geology, Mathematics, and Physics. A minimum of 3 hours of course work numbered 700 or above must be included. The prerequisite requirements are those listed in the departmental statements of both selected academic areas of emphasis.

Courses from one of the above disciplines	9 hrs	
Courses from a second of the above disciplines	6 hrs	
Total		15 hrs

Mathematics Courses

MTH 603 Advanced Calculus I

Prerequisite: MTH 280 and MTH 315. Concepts of limit, continuity, differentiation, Riemann integration, sequences and series, other related topics. May be taught concurrently with MTH 503. Cannot receive credit for both MTH 503 and MTH 603. 3(3-0) F,S

MTH 604 Advanced Calculus II

Prerequisite: MTH 302; and MTH 503 or MTH 603. This is a continuation of MTH 603, including sequences and series of functions, uniform convergence, multivariate calculus, and other selected topics. May be taught concurrently with MTH 504. Cannot receive credit for both MTH 504 and MTH 604. 3(3-0) D

MTH 605 Theory of Functions of a Complex Variable

Prerequisite: MTH 280 and MTH 315. Theory of elementary functions-polynomial, trigonometric, exponential, hyperbolic, logarithmic-of a complex variable; their derivatives, integrals; power series; other selected topics. May be taught concurrently with MTH 506. Cannot receive credit for both MTH 506 and MTH 605. 3(3-0) D

MTH 607 Introduction to Partial Differential Equations

Prerequisite: MTH 302 and MTH 303 and MTH 315. Introduction to linear first and second order partial differential equations, including some formal methods of finding general solutions; the Cauchy problem for such equations, existence theorems, formal methods of finding the solution, and the role of characteristics; the classical boundary and initial value problems for the wave equation, heat equation and the boundary value problems for Laplace's equation. May be taught concurrently with MTH 507. Cannot receive credit for both MTH 507 and MTH 607. 3(3-0) D

MTH 631 Introduction to Abstract Algebra

Prerequisite: MTH 302 and MTH 315. Theory of groups, rings, integral domains, fields, polynomials. May be taught concurrently with MTH 532. Cannot receive credit for both MTH 532 and MTH 631. 3 (3-0) F

MTH 633 Linear Algebra I

Prerequisite: MTH 280 and MTH 315. Vector spaces, linear independence, inner product spaces, linear transformations, Eigenvectors, diagonalization. May be taught concurrently with MTH 533. Cannot receive credit for both MTH 533 and MTH 633. 3(3-0) F,S

MTH 634 Linear Algebra II

Prerequisite: MTH 533 or MTH 633. Topics include eigenvalue problems; Jordan normal form, linear functionals, bilinear forms, quadratic forms, orthogonal and unitary transformations, Markov processes, and other topics selected by the instructor. May be taught concurrently with MTH 534. Cannot receive credit for both MTH 534 and MTH 634. 3 (3-0) D

MTH 636 Theory of Numbers

Prerequisite: MTH 302 and MTH 315. Factorization, Euler totient function, congruences, primitive roots, quadratic residues and reciprocity law. May be taught concurrently with MTH 536. Cannot receive credit for both MTH 536 and MTH 636. 3(3-0) D

MTH 637 Applied Abstract Algebra

Prerequisite: MTH 532 or MTH 632 or MTH 533 or MTH 633. Topics typically include finite fields, block designs, error-correcting codes (nonlinear, linear, cyclic, BCH, and Reed-Solomon codes), cryptography, and computer implementation of these applications. May be taught concurrently with MTH 537. Cannot receive credit for both MTH 537 and MTH 637. 3 (3-0) D

MTH 640 Statistical Theory I

Prerequisite: MTH 302 and MTH 315. Random variables, discrete and continuous probability functions, expectation, moment-generating functions, transformation of variables. May be taught concurrently with MTH 540. Cannot receive credit for both MTH 540 and MTH 640. 3(3-0) F

MTH 643 Statistical Theory II

Prerequisite: MTH 540 or MTH 640 or equivalent. Estimation, complete and sufficient statistics, maximum likelihood estimation, hypothesis testing, nonparametric statistics. May be taught concurrently with MTH 541. Cannot receive credit for both MTH 541 and MTH 643. 3(3-0) S

MTH 645 Applied Statistics

A course on statistical concepts, methods and data analysis with emphasis on assumptions and effects on violating those assumptions. Computer statistical packages will be used. Topics include statistical models, random sampling, normal distribution, estimation, confidence intervals, tests and inferences in single and two populations, and n-way analysis of variance. May be taught concurrently with MTH 545. Cannot receive credit for both MTH 545 and MTH 645. 3(3-0) F

MTH 646 Analysis of Variance and Design of Experiments

Prerequisite: MTH 345 or MTH 541 or MTH 643 or MTH 545 or MTH 645. Topics include analysis of variance, estimation of variance components, randomized incomplete blocks, Latin squares, factorial nested, split-plot designs, fixed, random and mixed models. May be taught concurrently with MTH 546. Cannot receive credit for both MTH 546 and MTH 646. 3(3-0) D

MTH 647 Applied Regression Analysis

Prerequisite: MTH 345 or MTH 541 or MTH 643 or MTH 545 or MTH 645. Topics include fitting a straight line, matrix models, residuals, selecting best equation, multiple regression, and nonlinear estimation. May be taught concurrently with MTH 547. Cannot receive credit for both MTH 547 and MTH 647. 3(3-0) D

MTH 648 Applied Time Series Analysis

Prerequisite: MTH 540 or MTH 640; and MTH 345 or MTH 541 or MTH 643 or MTH 545 or MTH 645. This course will study the analysis of data observed at different points of time. Topics include stationary and non-stationary time series models, linear time series models, autoregressive models, autocorrelations, partial autocorrelations, moving average models, ARMA models, ARIMA models, forecasting, prediction limits, model specification, least square estimation, and seasonal time series models. Computer statistical packages will be used. May be taught concurrently with MTH 548. Cannot receive credit for both MTH 548 and MTH 648. 3(3-0) F

MTH 653 Stochastic Modeling

Prerequisite: MTH 540 or MTH 640. This course will study applications of probability and statistics from a modeling point of view. Topics include generating functions, branching processes, discrete time Markov chains, classification of states, estimation of transition probabilities, continuous time Markov Chains, Poisson processes, birth and death processes, renewal theory, queuing systems, Brownian motion, and stationary processes. Computer statistical packages will be used. May be taught concurrently with MTH 543. Cannot receive credit for both MTH 543 and MTH 653. 3(3-0) S

MTH 667 Introduction to Non-Euclidean Geometry

Prerequisite: MTH 302 and MTH 315. Development of non-Euclidean geometries; intensive study of hyperbolic geometry. May be taught concurrently with MTH 567. Cannot receive credit for both MTH 567 and MTH 667. 3(3-0) S

MTH 670 Combinatorial Analysis

Prerequisite: MTH 280 and MTH 315. An introduction to combinatorial analysis including enumeration methods, combinatorial identities with applications to the calculus of finite differences and difference equations. May be taught concurrently with MTH 570. Cannot receive credit for both MTH 570 and MTH 670. 3(3-0) D

MTH 675 History of Mathematics

Prerequisite: MTH 302 and MTH 315. Development of mathematics through the calculus; solution of problems of historical interest, problems which use historically significant techniques; problems whose solutions illuminate significant mathematical characteristics of elementary mathematics. May be taught concurrently with MTH 575. Cannot receive credit for both MTH 575 and MTH 675. 3(3-0) F,S

MTH 680 Applied Mathematics

Prerequisite: MTH 303; and MTH 533 or MTH 633. An introduction to several areas of applied mathematics including control theory, optimization, modeling of population dynamics, modeling of mathematical economics, minimax and game theory, and calculus of variations. May be taught concurrently with MTH 580. Cannot receive credit for both MTH 580 and MTH 680. 3(3-0) D

MTH 682 Introductory Topology

Prerequisite: MTH 302 and MTH 315. Properties of abstract metric and topological spaces; discussion of concepts of compactness and connectedness. May be taught concurrently with MTH 582. Cannot receive credit for both MTH 582 and MTH 682. 3(3-0) D

MTH 696 Readings

Prerequisite: permission of department head. Periodic conferences with an advisor are required. May be repeated to a total of 6 hours. May be taught concurrently with MTH 596. Cannot receive credit for both MTH 596 and MTH 696. 1-3 F,S

MTH 701 Real Analysis

Prerequisite: MTH 503 or MTH 603. Topics include countable and uncountable sets, convergence, Lebesgue measure on the real line, the development of the Lebesgue integral, the fundamental theorem of calculus and L_p spaces. 3(3-0) D

MTH 702 Real and Abstract Analysis

Prerequisite: MTH 701. A study of the theory of abstract measures and integration, and an introduction to functional analysis. 3(3-0) D

MTH 706 Complex Analysis

Prerequisite: MTH 503 or MTH 603. Analytic functions, power series, Cauchy's theorem and its applications, residues. Selected topics from conformal mapping, analytic continuation, harmonic functions, Fourier series, and Dirichlet problems. 3 (3-0) D

MTH 710 Contemporary Mathematics for Secondary Teachers

Prerequisite: MTH 460; and MTH 533 or MTH 633. Reports, research, and recent trends in secondary mathematics; recently developed programs in algebra and geometry. 3(3-0) D

MTH 721 Theory of Ordinary Differential Equations I

Prerequisite: MTH 303; and MTH 503 or MTH 603. Existence and uniqueness theorems for first order differential equations; system of linear and nonlinear differential equations; continuous dependence of solutions on initial conditions and parameters; behavior of solutions of equations with constant coefficients, study of Lyapunov's theorems on stability; introduction to boundary value problems. 3 (3-0) D

MTH 722 Theory of Ordinary Differential Equations II

Prerequisite: MTH 721. Theory and application of boundary value problems; periodic solutions; linear systems with periodic coefficients (Floquet theory); two dimensional (autonomous) systems limit cycles. Differential equations under Caratheodory conditions; theory of differential and integral inequalities and other selected topics, if time permits. 3(3-0) D

MTH 730 Abstract Algebra I

Prerequisite: MTH 532 or MTH 631; and MTH 533 or MTH 633. Topics from group theory will include Cayley's Theorem, finite abelian groups, Cauchy's Theorem, the Sylow Theorems, and free groups. 3(3-0) D

MTH 732 Abstract Algebra II

Prerequisite: MTH 730. Topics from ring theory will include the Chinese Remainder Theorem, Euclidean domains, rings of fractions, PID's and UFD's, and polynomial rings. Topics from field theory will include splitting fields, Galois Theory, separability, normality, and finite fields. 3(3-0) D

MTH 741 Statistical Inference I

Prerequisite: MTH 540 or MTH 640 or equivalent. Formulation of statistical models, sufficiency and exponential families, methods of estimation, optimality theory. Uniformly minimum variance unbiased estimators, Fisher information, Cramer/Rao inequality, large sample theory, Bayes procedures and minimax procedures. 3(3-0) D

MTH 742 Statistical Inference II

Prerequisite: MTH 741. Confidence intervals and regions, hypothesis testing, the Neyman-Pearson framework, uniformly most powerful tests, likelihood ratio criteria, power functions, similar regions, invariant tests, distribution free tests. 3(3-0) D

MTH 781 Topology

Point set topology in abstract spaces. 3(3-0) D

MTH 791 Seminar I

Seminar in Mathematics. 2(2-0) F,S

MTH 792 Seminar II

Seminar in Mathematics. 2(2-0) F,S

MTH 796 Science Internship

Completion of an internship project (480 hours) at a discipline-related business, nonprofit organization, or government agency, approved and supervised by both the departmental and internship advisors. Includes a formal report in the appropriate professional format, and an oral presentation at an approved venue. Graded Pass/Not Pass only. No more than 6 hours may count toward a masters degree. 1-6 F,S,Su

MTH 797 Topics

Prerequisite: permission of department head. Material covered determined by the interests and backgrounds of the students. May be repeated for a maximum of 6 hours. 3(3-0) D

MTH 798 Research

Supervised research in special areas of mathematics. May be repeated. May not be counted toward the Master of Science in Education degree. 1-6 F,S

MTH 799 Projects

Independent research for thesis preparation. 1-6 F,S

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Department of Physics, Astronomy, and Materials Science

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Programs

Master of Science, Materials Science

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Program Description

The Materials Science degree is designed to provide the graduate with a suitable background for employment in the exciting field of electronic materials. Specifically, students will receive experience in high-technology materials synthesis and characterization, including the operation and design of the equipment used to make integrated circuits.

This degree was designed for students with good experimental skills, but little practical knowledge of specific instrumentation. Graduates will be prepared for employment in areas of semiconductor manufacturing, materials synthesis and testing, and other industries where high technology processing and development are required.

The program requires 9-12 hours of course work, 9 hours of laboratory course work, 6 hours of electives, 9-12 hours of thesis research and 1 hour of seminar, for a total of 37 hours. Interdisciplinary courses taught in other departments may be used for electives if approved by the department head in advance.

At the beginning of the first semester, students' background will be evaluated to determine the student's optimum path of study. Based on the results of the students' initial evaluation, poorly prepared students may be required to take some additional course work that will not apply to the degree. Later in the first semester, the student will interview with faculty members to choose an area of thesis research.

A comprehensive examination is required usually one semester prior to graduation. The comprehensive examination is used to monitor the progress of each student through the program. At the end of the thesis project, the student will present his or her results in the form of a public thesis presentation or defense.

Entrance Requirements

Students admitted to the program in full standing must meet the following requirements.

1. A Bachelor of Science degree in any science or engineering discipline which includes:
 - a. a calculus sequence and differential equations;
 - b. a calculus-based physics sequence; and
 - c. two semesters of physical chemistry or thermodynamics and modern physics.

For example, the following would constitute adequate preparation:

MTH 261 Analytical Geometry and Calculus I

MTH 280 Analytical Geometry and Calculus II

MTH 303 Differential Equations

PHY 203 Foundations of Physics I

PHY 204 Foundations of Physics II

PHY 343 Thermodynamics **OR** CHM 506 Physical Chemistry I

PHY 375 Modern Physics **OR** CHM 507 Physical Chemistry I

Applicants with some deficiency in the courses listed in (1) above, may be admitted, but may have additional course work added to their program. This additional course work may not count toward their graduate degree.

2. Candidates for admission to the program are required to have a GPA of at least 3.00 on a 4.00 scale on the last 60 hours of course work.
3. Submission of Graduate Record Examination (GRE) scores from the General Test is required.
4. Three letters of reference.

Students who do not meet the GPA or GRE standards described in (3) and (4) above may be granted conditional admission to the program. Conditionally admitted students will be required to complete a minimum of nine hours of specified course work with a GPA of at least 3.00 to be advanced to full standing in the program.

Retention Requirements

The student is expected to demonstrate effective communication skills while enrolled in the program. Evaluation of communication skills will be done in accordance with the student's background. These abilities will be evaluated for graduate assistants based on their teaching performance and by the [MAT 798](#) Seminar course.

For students who are not graduate assistants, evaluation will be done in the [MAT 798](#) Seminar course. For the student who uses English as a second language, there may be additional requirements.

The student must also demonstrate progress toward graduation in the following ways:

1. satisfactory performance in the comprehensive exam, given approximately one semester before graduation;
2. maintenance of a 3.00 GPA in the core courses;

3. satisfactory progress in thesis research.

Degree Requirements (minimum of 37 hours)

1. For the student who has not received a “C” or better in a quantum mechanics course or its equivalent prior to admission to the program, satisfactory completion of [PHY 675](#) Introduction to Quantum Mechanics is required.
2. Required core:
 1. [MAT 640](#) Thermodynamics of Materials
 2. [MAT 651](#) Introduction to Materials Science
 3. [MAT 681](#) Structure of Solids
 4. [MAT 750](#) Experimental Design
 5. [MAT 760](#) Experiments in Physical Characterization
 6. [MAT 770](#) Vapor Synthesis of Materials
3. Six hours, with at least 3 hours at the 700 level or above, chosen from the following:
 1. [PHY 643](#) Kinetic Theory and Statistical Mechanics
 2. [PHY 653](#) Electromagnetic Field Theory
 3. [MAT 720](#) Advanced Quantum Mechanics
 4. [MAT 758](#) Optoelectronic Materials
 5. [MAT 780](#) Polymer Preparation and Characterization
 6. [MAT 790](#) Statistical Application in Materials Science
 7. Interdisciplinary Courses approved by the department head for elective credit. Examples: [BMS 614](#), Scanning Electron Microscopy or [CHM 614](#) Polymer Chemistry
4. Seminar. 1 hour of seminar, [MAT 798](#).
5. Research. 9-12 hours of research, [MAT 799](#) (up to 6 hours must be thesis research - see #6 Thesis Research).
6. Thesis Research. Satisfactory completion of an approved thesis and an oral thesis defense to the student's faculty advisor and a committee of graduate faculty is also required.
7. Comprehensive Examinations. A passing grade on the comprehensive examination, taken approximately one semester before graduation.

Accelerated Master's Option

Undergraduate Physics majors may wish to enroll in the Accelerated Master of Science degree program in Materials Science. Students who successfully complete this program can obtain a Physics Bachelor of Science degree and a Master of Science in Materials Science degree within five years.

This challenging option is for students who have a strong interest in becoming experts in electronic materials. This includes the fields of Solid State Physics, Photonics, Opto-electronics, Electrical Engineering, and computer Engineering.

While not essential for eventual admission to the program, it is strongly recommended that, as freshmen, students contact the department head for permission to become involved in the program. This will allow for appropriate advisement during the undergraduate years.

Students may be admitted to the program after completing 60 hours with a 3.00 cumulative GPA, including the physics core courses

with a 3.50 cumulative GPA.

Students seeking this option must:

- Obtain admission to the Master of Science in Materials Science accelerated program by applying to the Graduate College prior to their senior year.
- Pass the Master of Science in Materials Science comprehensive examination in the first semester of their fifth year.

Before enrolling in a course to be counted as both undergraduate and graduate credit and to count the courses towards the masters degree, an undergraduate student must be accepted into the accelerated program and receive prior approval from the graduate program advisor, department head of the undergraduate program, and the dean of the Graduate College. Acceptance into the program and all approvals must be completed prior to the end of the Change of Schedule Period for the course(s). See the Graduate College for further information.

Nine hours of course work may be counted toward both the undergraduate and the masters degree. These courses are MAT 640, MAT 651 and MAT 681.

Students who successfully meet all the requirements would receive a Bachelor of Science degree in Physics at the end of their fourth year, and a Master of Science at the end of their fifth year.

Master of Natural and Applied Science

[See program description listed in the Graduate College section under Interdisciplinary Programs. Accelerated masters opportunity available.](#)

Master of Science in Education, Secondary Education: Physics area of Emphasis

Contact Dr. Bill Thomas and [see program requirements for the M.S.Ed., Secondary Education under Interdisciplinary Graduate Programs.](#)

Physics Requirements

Physics course work with a minimum of 3 hours in courses numbered 700 or above to **total 15 hours**.

Master of Science in Education, Secondary Education: Natural Science Area of Emphasis

Contact Dr. Tamera Jahnke and [see program requirements for the M.S.Ed., Secondary Education under Interdisciplinary Graduate Programs.](#)

Natural Science Prerequisite and Requirements

In this option, students complete a minimum of 15 hours with course work selected from two of the following disciplines: Biology, Chemistry, Geography and/or Geology, Mathematics, and Physics. A minimum of 3 hours of course work numbered 700 or above must be included. The prerequisite requirements are those listed in the departmental statements of both selected academic areas of emphasis.

Courses from one of the above disciplines	9 hrs
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Courses from a second of the above disciplines	6 hrs
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Total	15 hrs
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Astronomy Courses

AST 613 Solar and Extra-Solar Systems

Prerequisite: AST 114 or AST 115; and MTH 303. Formation of planetary systems, planetary dynamics, and comparative planetology. Project required. Cannot receive credit for both AST 313 and AST 613. May be taught concurrently with AST 513. Cannot receive credit for both AST 513 and AST 613. 3(3-0) FO

AST 615 Stellar Structure and Evolution

Prerequisite: AST 114 or AST 115; and MTH 303. Basic concepts of stellar structure, atmospheres, and evolution. Project required. Cannot receive credit for both AST 315 and AST 615. May be taught concurrently with AST 515. Cannot receive credit for both AST 515 and AST 615. 3(3-0) SO

AST 617 Galaxies and Cosmology

Prerequisite: AST 114 or AST 115; and MTH 303. Study of galaxies and the Universe. Topics include the structure and content of our Galaxy and other galaxies, clusters of galaxies, the Big Bang theory (including Inflation), and the eventual fate of our Universe. Project required. Cannot receive credit for both AST 317 and AST 617. May be taught concurrently with AST 517. Cannot receive credit for both AST 517 and AST 617. 3(3-0) SE

AST 711 Astronomy for Teachers

Theory and techniques of observational astronomy. 3(2-2) D

Physics Courses

PHY 602 Physics and Astronomy By Inquiry

Prerequisite: PHY 101. This course is a continuation of PHY 101. Additional topics in mechanics, optics, heat, electricity and magnetism will be covered. The course will also include an introduction to Astronomy. Concepts will be explored using the inquiry approach. Will not count towards a major or minor in physics. May be taught concurrently with PHY 501. Cannot receive credit for both PHY 501 and PHY 602. 2(1-2) F

PHY 609 Special Topics in Physics and Astronomy

Prerequisite: permission. Variable content, variable credit course. Topics to be chosen from current areas of interest. May be repeated to a total of 6 hours with different topic. May be taught concurrently with PHY 509. Cannot receive credit for both PHY 609 and PHY 509. 1-3 D

PHY 675 Quantum Mechanics

Prerequisite: PHY 375 or CHM 607. A mathematical development of the principles of quantum mechanics and their application to selected systems. Topics include Schrodinger's equation, operators, Heisenberg uncertainty principle, angular momentum, and applications, including the hydrogen atom. May be taught concurrently with PHY 575. Cannot receive credit for both PHY 575 and PHY 675. 3(3-0) F

PHY 701 Workshop on Topical Issues in Science Education

Prerequisite: permission. Workshop to upgrade understanding of selected topics in science, and improve elementary, middle school and/or secondary science teaching. Each workshop will include performance and analysis of appropriate investigations to enhance understanding of the selected topics. Number of class hours determined by semester hours of credit. Variable content course. May be repeated to a maximum of 6 hours provided the topics are different. 1-3 D

PHY 785 Physics Laboratory for Teachers

Prerequisite: permission. Performance and analysis of secondary laboratory experiments in physics. 3(1-4) D

PHY 790 Seminar in Physics

Prerequisite: permission. Extensive paper on agreed topic in physics or astronomy to be read before staff seminars. May be repeated to a total of 4 hours. 2(2-0) D

PHY 796 Science Internship

Completion of an internship project (80 hours/credit hour) at a discipline-related business, nonprofit organization, or government agency, approved and supervised by both the departmental and internship advisors. Includes a formal report in the appropriate professional format, and an oral presentation at an approved venue. Graded Pass/Not Pass only. No more than 6 hours may count toward a masters degree. 1-6 F,S,Su

PHY 799 Research in Natural and Applied Sciences

Prerequisite: permission of department head. Supervised research in the natural and applied sciences. May be repeated, but no more than 12 hours may be counted toward the masters degree. Credit may not be applied toward the Master of Science degree in Materials Science. 1-6 D

Materials Science Courses

MAT 609 Special Topics in Materials Science

Prerequisite: permission of instructor. Variable content course. Topics to be chosen from current areas of interest in Materials Science. May be repeated to a total of 6 hours with a different topic. May be taught concurrently with MAT 509. Cannot receive credit for both MAT 509 and MAT 609. 1-3 D

MAT 640 Thermodynamics of Materials

Prerequisite: PHY 343 or CHM 506 or CHM 606. Review of classical thermodynamics, equilibrium in thermodynamic systems, the statistical interpretation of entropy, unary and multi-component systems, thermodynamics of phase diagrams and phase equilibrium. May be taught concurrently with MAT 540. Cannot receive credit for both MAT 540 and MAT 640. 3(3-0) F

MAT 651 Introduction to Materials Science

Prerequisite: PHY 375 or CHM 507 or CHM 607. Investigation of the relationships that exist between the structure, properties, processing and performance of materials. Different types of materials will be studied with a special emphasis on polymers and semiconductors. Structure-property correlations, including electronic, thermal, and mechanical properties, will be presented for these materials. May be taught concurrently with MAT 550. Cannot receive credit for both MAT 550 and MAT 651. 3(3-0) F

MAT 681 Structure of Solids

Prerequisite: PHY 375 or CHM 507 or CHM 607. Review of quantum mechanics, followed by an in-depth study of crystal structures, energy band structures in solids, lattice dynamics, and a survey of the physical properties of solids. May be taught concurrently with MAT 580. Cannot receive credit for both MAT 580 and MAT 681. 3(3-0) F

MAT 720 Advanced Quantum Mechanics

Advanced topics in quantum mechanics including variational methods, approximation techniques, time-independent and time-dependent perturbation theory, second quantization, and the interactions of light with matter. 3(3-0) S

MAT 750 Experimental Design

Laboratory techniques necessary for the development of instrumentation. Topics will include elementary computer interfacing, prototype design, mechanical and electronic construction, and reliability testing. The student will develop, design and build a test instrument and study each of the above topics during this process. 3(1-4) F

MAT 758 Optoelectronic Materials

Course includes the study of advanced electronic properties of materials, lattice dynamics, and a survey of the optical-electronic interactions in materials. 3(3-0) S

MAT 760 Experiments in Physical Characterization

Prerequisite: MAT 651. Laboratory techniques in electronic, optical, and thermal characterization of materials. Students will become familiar with equipment and procedures used in research and commercial laboratories. 3(1-4) S

MAT 770 Vapor Synthesis of Materials

Experimental techniques in the vapor deposition of thin film materials used in the electronics industry. Some modification of the resulting films including chemical doping and ion implantation will also be studied. Experimental methods including computer control and analysis will be studied. 3(1-4) S

MAT 780 Polymer Preparation and Characterization

Preparation of polymers, including the techniques of condensation polymerization, free radical polymerization, and if time permits, plasma polymerization. Characterization experiments will be viscosity measurements, differential scanning calorimetry, and thermal gravimetric analysis. Film preparation including spin coating, aspiration, and doctor blade systems will also be investigated. 3(1-4) S

MAT 790 Statistical Applications in Materials Science

Selective topics in materials science important to the design, testing, fabrication, and manufacture of materials whose underlying theme is mathematical modeling based in statistical methods. The topics include mass transport in solids, atomic diffusion on surfaces, adsorption and desorption on surfaces, epitaxial growth, degradation of materials, queuing theory, and operations research. 3(3-0) S

MAT 796 Science Internship

Completion of an internship project (480 hours) at a discipline-related business, nonprofit organization, or government agency, approved and supervised by both the departmental and internship advisors. Includes a formal report in the appropriate professional format, and an oral presentation at an approved venue. Graded Pass/Not Pass only. No more than 6 hours may count toward a masters degree. 1-6 F,S,Su

MAT 798 Seminar in Materials Science

Prerequisite: candidate for the MS degree in Materials Science. Selected topics in materials science of a theoretical, experimental, or applied nature with an emphasis on recent developments and their impact. May be repeated for a maximum of 4 hours. 1 S

MAT 799 Research in Materials Science

Prerequisite: permission. Supervised research in areas of materials science. May be repeated, but no more than 12 hours may be counted toward the MS degree. 1-6 D

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