# **COLLEGE OF SCIENCES AND HUMANITIES**

<u>www.bsu.edu/sh</u> North Quadrangle Building 112, 765-285-1042 Dean of the College: Michael A. Maggiotto Associate Deans: Susan M. Johnson, Jeffry Grigsby, Kecia McBride

# INTERDEPARTMENTAL PROGRAMS

# SCIENCE

www.bsu.edu/physics

#### MASTER OF ARTS IN SCIENCE EDUCATION

PREFIX NO SHORT TITLE CR HRS

Common core, 12 hours Approved science education courses 6 699 Res Mth Ed SCI 3 RES 697 Research Ppr (1-3) or CRPRJ 698 Creat Proj (3 or 6) 3 Complete one option Option 1: High school, 18 hours 690 Wkshp Sci Ed SCI 0-9 and/or approved course work in one or more of the following content areas:

biology, chemistry, earth/space science (geology and/or astronomy), environmental science, or physics 9-18

18 hrs

Option 2: Elementary/middle school, 18 hours SCI 690 Wkshp Sci Ed 0-9 and/or approved course work in at least three of the following content areas: biology, chemistry, earth/space science (geology and/or astronomy), environmental science, or physics 9-18

18 hrs

30 hrs

The student will conduct science education research and write a research paper (RES 697) or do a creative project (CRPRJ 698) on a science education topic. The research paper or creative project earns a total of three hours credit.

# DOCTORAL PROGRAMS

# DOCTOR OF EDUCATION (EdD) IN SCIENCE EDUCATION

This degree prepares graduates to assume positions as science education specialists in a variety of settings. Option 1 is for individuals who will work at the university level as K-12 science teacher preparation experts. Option 2 is for individuals who will work as science content faculty in 2 or 4-year colleges and universities where high priority is placed on teaching. The major consists of course work in science content, science education, and research methodologies. A dissertation is written in either science or science education in the student's major science field. A teaching internship, a required part of the program for both options, allows candidates to acquire experience in the techniques of conventional as well as technology-oriented systems instruction. The program requires a minimum of 90 hours of approved graduate work beyond the bachelor's degree. Science fields include: biology, chemistry, geological sciences, natural resources and environmental management, and physics and astronomy.

# **Degree requirements**

PREFIX NO SHORT TITLE CR HRS

*Option 1* Graduate and Undergraduate Teacher Preparation Institutions Science Education Faculty

Science Content (2 or more fields)			30
Science E	Educat	ion	
SCI	690	Wkshp Sci Ed (1-12	)
	692	Topics HNOS (3)	
	695	Adv Tch Sci (3-6)	
	696	Cur Is Sc Ed (3-6)	
	790	Intern Sc Ed (1-4)	18
Research	Metho	odologies	
EDPSY	641	Statist Meth	3
EDSTU	650	Int Qual Rsh	3
ID	705	Resrch Collq (1-3)	2
SCI	699	Res Mth Ed	3

6 hours fi	om		
EDPSY	640 642 741 742 743	Methodology (3) Interim Stat (3) Ap Regres An (3) Statist Tech (3) Eactor Analy (3)	
EDSTU	660 735	Ethno Res Ed (3) Resrch Teach (3)	6
			17 hrs
Education	1		
EDCUR	601	Curric Devel	3
EDFON	631	Philosphy Ed	3
LDI OIT	641	Hist Amer Ed	3
	011		
			9
6 hours fi	om		
EDCUR	610	Elem Sch Cur (3)	
	or		
	620	Sec Sch Cur (3)	
	or		
	630	Jr H Mid Cur (3)	
EDFON	621	Educ Ethics (3)	
EDPSY	600	Adv Ed Psy (3)	
	606	Lrn & Motiv (3)	
	628	Adoles Devel (3)	
PSYSC	616	Percp Cognit (3)	
	618	Thinking (3)	6
			15 hrs
Dissertati	on/Re	cord of Study	
DISS	799	Drs Dissert (1-24)	10
			90 hrs
Ortica 2			
College ( College/S Science F	Comm Small I Faculty	unity College/Junic Liberal Arts College	or 2)
Colores	7		
(at least 2	A hour	t rs in one field)	36
Science E SCI	Educat 690 692 695 696	ion Wkshp Sci Ed (1-1 Topics HNOS (3) Adv Tch Sci (3-6) Cur Is Sc Ed (3-6)	2)

790 Intern Sc Ed (1-4) 15

Research	Meth	odologies	
ID	705	Resrch Collq (1-3)	2
SCI	699	Res Mth Ed	3
			5
			5
9 hours fr	rom		
BIO	548	Biometry (3)	
CHEM	500	Chem Comunic (1)	)
	and		
	696	Resrch Meth (2)	
EDPSY	641	Statist Meth (3)	
	642	Interim Stat (3)	
	742	Statist Tech (3)	
	743	Factor Analy (3)	
EDSTU	660	Ethno Res Ed (3)	
	735	Resrch Teach (3)	
GEOL	685	Geo Res Meth (3)	
NREM	572	App Res Meth (3)	
PHYCS	681	Resour Meth (3)	9
			14 hrs
Education	n		
EDHI	609	Prep Prof (3)	
	611	Tch Cur H Ed (3)	6
9 hours f	rom		
EDAC	634	Adlt Learner (3)	
	635	Tchg Adlts (3)	
	638	Pro Com Adlt (3)	
EDFON	631	Philsophy Ed (3)	
	641	Hist Amer Ed (3)	
EDHI	601	Theor St Dev (3)	
	602	Amer Col Stu (3)	
EDPSY	600	Adv Ed Psy (3)	
	606	Lrn & Motiv (3)	
	629	Adult Devel (3)	9
			15 hrs

Dissertation/Record of Study DISS 799 Drs Dissert (1-24) 10

90 hrs

# DOCTOR OF PHILOSOPHY (PhD) IN ENVIRONMENTAL SCIENCE

This degree prepares graduates for careers in post-secondary education, where research is among the professional expectations and for careers in scientific research in the public and private sectors. Unique to this degree is its interdisciplinary focus. Each student's program originates in a major discipline, is complemented by course work from other scientific disciplines, and culminates in a dissertation that draws from more than one discipline. Each student will participate in an interdisciplinary research seminar every semester in residence and will present his/her research at several meetings of the seminar. Students develop the skills necessary to pursue complex questions in environmental science that require an interdisciplinary approach. Applicants must meet the admission requirements of the Graduate School.

#### **Degree requirements**

PREFIX NO SHORT TITLE CR HRS

Environmental science core, 21 hours

BIO	656	Ecosystems	3
	657	Mult Env Dat	3
CHEM	626	Adv Analytic	3
	627	Env Analysis	3
GEOL	660	Sem Hydrogeo	3
	670	Sem Geochem	3
ID	705	Resrch Collq (1-3)	3
			21 hrs
DISS	799	Drs Dissert (1-24)	21 hrs 10
DISS SCI	799 790	Drs Dissert (1-24) Intern Sc Ed (1-4)	21 hrs 10 3

90 hrs

#### SCIENCE (SCI)

**501 Electron and Confocal Microscopy. (3)** Introduction to the techniques and theory of electron and confocal microscopy. Emphasizes basic procedures employed in specimen preparation, production of micrographs and operation of the transmission, scanning, and confocal microscopes.

#### 690 Workshop in Science Education.

(1-12) Practical experience with teaching science at specific level (early childhood, elementary, middle, secondary, or higher education) and/or specific topic (e.g., chemistry or geology). May be repeated for different level and/or topic.

*Prerequisite:* teaching experience or certification or permission of the instructor.

A total of 24 hours of credit may be earned, but no more than 12 in any one semester or term.

**692 Topics in the History and Nature of Science.** (3) Examination of the historical development of science from a wide variety of perspectives. Roles of scientists, society, culture, and gender in the creation and validation of scientific knowledge. Implications of the Nature of Science for science teaching and learning.

**695** Advanced Teaching Methods in Science. (3-6) Recent developments in science teaching at specific level (early childhood, elementary, middle, secondary, or higher education) and/or specific topic (e.g., biology or physics). May be repeated for different level and/or topic.

*Prerequisite:* teaching experience or certification or permission of the instructor. A total of 6 hours of credit may be earned.

# 696 Current Issues in Science Education.

(3-6) Current research and theory of teaching

science at specific level (early childhood, elementary, middle, secondary, or higher education) and/or specific science topic (e.g., chemistry or geology). May be repeated for different level and/or topic.

Prerequisite: permission of the instructor.

A total of 6 hours of credit may be earned.

**699 Research Methodology in Science Education. (3)** Identification of research problems in science and science education. Introduction to types of research, research design, and grant-writing. Review of literature pertinent to a special topic of student interest. Development of a research proposal.

Prerequisite: permission of the department chairperson.

**790 Internship in Science Education.** (1-4) Supervised experience in instruction of science or science education courses.

*Prerequisite:* permission of the department chairperson. A total of 4 hours of credit may be earned.

# SOCIAL STUDIES

<u>www.bsu.edu/history</u> Director of Master's Program: Sarah Drake Brown

## MASTER OF ARTS IN SOCIAL SCIENCE

## **Admission requirements**

Applicants must meet the admission requirements of the Graduate School. To qualify for a graduate assistantship in the department, an applicant must take the general and subject (one of the social science disciplines) tests of the Graduate Record Examination (GRE) and ordinarily have an undergraduate GPA of at least 3.0 on a scale of 4.0.

## **Degree requirements**

PREFIX NO SHORT TITLE CR HRS

Major requirements

Courses from anthropology, economics, geography, government, psychology, sociology, United States history, and world civilization; at least one social studies methods course.

Three courses must be 600-level. 15

Research requirement

SS 694 Sem Cur Inst (1-5) or RES 697 Research Ppr (1-3) or THES 698 Thesis (1-6) 3-6 Minors and electives 9-12

30 hrs

# ANTHROPOLOGY

<u>www.bsu.edu/anthropology</u> Burkhardt Building 315, 765-285-1575

# PROGRAMS

Master of arts (MA) in anthropology

#### **Admission requirements**

Applicants must meet the admission requirements of the Graduate School, meet a cumulative undergraduate minimum GPA of 2.75 on a 4.0 scale, and have the approval of the departmental graduate committee. The graduate committee bases its decisions on the applicant's undergraduate transcripts; Graduate Record Examination (GRE) scores; written recommendations; and a 300-500 word narrative detailing relevant background, reasons for wishing to undertake graduate study in this department, and the relationship of such study to long-term goals and interests in anthropology. Applicants whose undergraduate majors are not anthropology or closely related subjects may be required to complete undergraduate courses to acquire background knowledge. Credit for these courses does not apply to degree requirements. It is suggested that students wishing to focus on archaeology participate in a summer field school or have equivalent experience before beginning studies.

# MASTER OF ARTS IN ANTHROPOLOGY

#### **Degree requirements**

The minimum requirement for the MA in anthropology is 32 hours of graduate credit. Although students are encouraged to take general courses, they may focus on cultural and biological anthropology or archaeology. In keeping with the principle that students should have a broad knowledge of anthropology, core courses covering those three major subdisciplines are required; this requirement can be waived only by the graduate committee. In order for students to acquire an understanding of anthropology as a profession and a background in anthropological thought, ANTH 600 Graduate Studies Seminar and a course emphasizing method and/or theory are also required. A required 6-hour thesis permits students to specialize and acquire skills in research methods and techniques. A public thesis defense presentation is also required. Beyond these requirements, each student's plan of study will be tailored to individual needs. The completed thesis document would be subject to approval by the committee following a public oral defense.

PREFIX NO SHORT TITLE CR HRS

Required	cours	es	
ANTH	600	Grad Sem (1)	2
	601	Scop Cultral	3
	603	Scop Archaeo	3
	605	Scop Biologi	3
THES	698	Thesis (1-6)	6
<ul> <li>3 hours from</li> <li>Method and/or theory approved by graduate committee</li> <li>12 hours from</li> <li>ANTH or other electives approved</li> </ul>		3	
by gradu	ate adv	visor	12
			32 hrs

# Graduate Minor in Anthropology

Requires a minimum of 9 hours of approved anthropology courses. Students wishing to pursue a minor should contact the department chairperson before taking any anthropology courses.

# CERTIFICATE IN INTERPRETIVE ETHNOGRAPHY

PREFIX	NO	SHORT TITLE	CR HRS
ANTH	601	Scop Cultral (3)	3
3 hours fi	rom		
ANTH	550	Ethn Fld Sch (3)	
	or		
	559	Ethno Method (3)	
	or		
	695	Resrch Method (3	) 3
9 hours fi	rom		
ANTH	542	Amer Culture (3)	
	550	Ethn Fld Sch (3)	
COMM	605	Qual Resrch (3)	
EDEL	676	Res Elem Edu (3)	
EDSTU	650	Int Qual Rsh (3)	
	660	Ethno Res Ed (3)	
PSYSC	595	Spec Topics (3)	
RELST	503	Read Spec St (3)	
SOC	583	Evaluation (3)	
	681	Survey (3)	9

15 hrs

# **ANTHROPOLOGY (ANTH)**

**501 History of Method and Theory in Anthropology.** (4) Surveys the major ideas and issues of anthropology over time. Includes methods and theories from archaeology, biological anthropology, linguistics, and cultural anthropology. For students without a strong undergraduate background in anthropology.

Not open to students who have credit in ANTH 301.

**505 Topics in Biological Anthropology. (3)** Covers a variety of advanced current and special topics in biological anthropology, depending on students' interests and capacities. May be repeated for different topics.

*Prerequisite:* an introductory biological anthropology course or permission of the instructor. A total of 9 hours of credit may be earned, but no more than 3 in any one semester or term.

**506 The Anthropology of Physical Growth and Development. (3)** Children's physical growth and development, its regulation, variation, and assessment in different times and places.

*Prerequisite:* an introductory physical anthropology course.

Not open to students who have credit in ANTH 306.

**507 Applied Anthropology. (3)** Investigates the problems and work that engage the attention of anthropologists outside the university setting. Examination of new skills needed to supplement those traditionally taught in anthropology.

Not open to students who have credit in ANTH 307.

**512 Ecological Dimensions of Culture. (3)** Explores the system of relationships between any human population and its environment, focusing on cultural behavior. Uses studies from ancient to modern times and models and theories from ecology and anthropology; considers both applied and theoretical perspectives.

*Prerequisite:* an introductory cultural anthropology course (waived for minors in environmentally sustainable practices) or permission of the instructor.

Not open to students who have credit in ANTH 312.

**515 Human Paleontology. (3)** Fossil record of the evolution of humans and their primate predecessors. *Prerequisite:* ANTH 206 or equivalent or permission of the instructor. *Not open to* students who have credit in ANTH 315.

**516 Human Osteology.** (3) Laboratory and lecture dealing with the human skeleton including identification of whole and fragmentary bones and the assessment of the age, stature, sex, and other traits of a skeleton as applied to paleodemography, paleopathology, and forensic problems.

*Prerequisite:* ANTH 206 or equivalent or permission of the instructor. *Not open to* students who have credit in ANTH 416.

**521 Social Organization.** (3) Provides a systematic cross-cultural analysis of human organizations from kinship-based societies to modern bureaucracies. Using an evolutionary approach, provides both theoretical perspectives and applied understanding.

Prerequisite: ANTH 101, 111 or permission of the instructor.

Not open to students who have credit in ANTH 321.

**525 Evolutionary Adaptation and Human Diversity. (3)** Human biological variation in the contemporary world: examination of its distribution, inheritance, development, and adaptiveness. *Prerequisite:* an introductory biological anthropology course or permission of the instructor.

Not open to students who have credit in ANTH 305.

**527 Culture and Medicine.** (3) Focuses on conceptions of health and illness from a cross-cultural perspective.

Not open to students who have credit in ANTH 427.

**529 Laboratory Methods in Material Culture.** (4) Addresses artifacts as reflections of culture. Focuses on ethnoarchaeology and experimental archaeology, as well as the integration of research design, recovery, identification, and laboratory analysis of artifacts from archaeological sites.

**530 Topics in Native North American Cultures. (3)** Topics in Native American cultures or study of Native American cultures of a particular region. May be repeated for different topics.

Not open to students who have credit in an undergraduate course covering the same topic.

**531 Native Americans of North America.** (3) Survey of cultures of North American Native Americans emphasizing their economic, socio-political, and religious institutions. *Not open to* students who have credit in ANTH 331.

**532 Native Americans of the Great Lakes.** (3) In-depth study of selected Native American cultures indigenous to the Great Lakes region from the time of European contact to the contemporary period. *Not open to* students who have credit in ANTH 332.

**534 Midwestern Archaeology. (3)** Archaeological development of the Midwest traced through the Paleo-Indian, Archaic, Woodland, and Mississippian stages.

Prerequisite: ANTH 103 or 204.

Not open to students who have credit in ANTH 334.

**537 Contemporary Problems of the Native Americans. (3)** Detailed study of current issues facing Native Americans. Particular issues facing tribes in specific regions and general issues of a pan-Native American nature will be covered.

Prerequisite: permission of the department chairperson.

A total of 6 hours of credit may be earned, but no more than 3 in any one semester or term. *Not open to* students who have credit in the corresponding undergraduate course in the same region.

**540** Anthropological Field Trip. (3-6) Exposes students to lifeways of groups outside mainstream society whose lives and communities are significantly shaped by the policies of the larger society. Can be used for trips in various subfields of anthropology when appropriate.

Prerequisite: permission of the instructor.

A total of 6 hours of credit may be earned.

**541** Anthropology and Women. (3) Development of the female phenotype; variation in the roles assigned in cultures of different levels of complexity, from gather-hunters to industrial societies—both Western and non-Western—and the contributions of women anthropologists to understanding this variation.

Not open to students who have credit in ANTH 341.

**542 American Culture.** (3) Examines how the values, beliefs, and norms of American culture are integrated into and symbolized in various media. Explores how Americans experience and resolve cultural tensions between individualism and community, equality and hierarchy, competition and cooperation.

Not open to students who have credit in ANTH 342.

**543 Historical Archaeology of Eastern United States. (3)** Explores primary historical processes and archaeologically significant trends in material culture that have shaped modern life since AD 1500. *Not open to* students who have credit in ANTH 343.

**545** Archaeological Field School. (3-6) Provides the practical application of archaeological methods, techniques, and strategies in a field setting. Participation in a supervised investigation of a formal archaeological problem at an actual archaeological site or at an experimental site.

*Prerequisite:* permission of the instructor.

A total of 6 hours of credit may be earned.

**550 Ethnographic Field School. (6-12)** An intensive immersion in the methods of field research in cultural anthropology. Emphasizes problem formulation, observation, interviewing, writing, and interpretation of field data. Field schools are intended to provide specific skills that result in an ethnographic report.

*Prerequisite:* permission of the instructor.

A total of 12 hours of credit may be earned.

**551 Witchcraft, Magic, and Religion.** (3) Anthropological study of humankind's age-old concern with life, death, sickness, and the unknown. Discusses human attempts to control life through supernatural beings, prayer, sacrifice, and techniques of magic and witchcraft.

Not open to students who have credit in ANTH 451.

**552** Anthropology of Technology. (3) Reviews the anthropological literature on technology, focusing on cultural and comparative aspects of technology. This subfield's theoretical base and research methods will also be assessed.

Not open to students who have credit in ANTH 452.

**555 Primatology. (3)** Comparative survey of nonhuman primates, their biology and behavior. *Prerequisite:* ANTH 206 or permission of the instructor. *Not open to* students who have credit in ANTH 455.

**557 Applied Archaeology. (3)** Special problems of contract, conservation, and public archaeology, including laws and guidelines, relations with governmental and private agencies, research design and proposals, field and laboratory methods, and curation.

Not open to students who have credit in ANTH 457.

**559 Ethnographic Methods. (3)** Develops the ability to conduct and comprehend ethnographic research. Includes research design, data collection, analysis, reporting, basic statistics, and computer use. Emphasizes both quantitative and qualitative techniques for basic and applied research.

*Prerequisite:* 15 hours of ANTH courses or permission of the instructor.

Not open to students who have credit in ANTH 459.

**560 Topics in Ethnology. (3)** Considers special topics not covered by regular courses. One topic is studied in a semester. May be repeated for different topics.

Not open to students who have credit in an undergraduate course covering the same topic.

**563 Theory and Method in Historical Archaeology. (3)** Presents a detailed summary of theory and methods used by historical archaeologists, including social theory, historical methods, and archaeological analysis methods.

Not open to students who have credit in ANTH 463.

**564 European Prehistory. (3)** Prehistory of Europe from the Paleolithic through the Iron Age emphasizing the regions north and west of the classical world.

Not open to students who have credit in ANTH 364.

**570 Topics in Regional Ethnography. (3)** Considers the culture of a selected geographic area not covered by regular courses. May be repeated for different areas.

Not open to students who have credit in an undergraduate course on the same geographic area.

**571 Ethnohistory. (3)** Methods and theories of ethnohistory introduced by emphasizing how culture and history intersect with race, ethnicity, gender, class, and sexuality; a research-intensive class. *Not open to* students who have credit in ANTH 471.

577 Topics in Museum Operations. (3) Introduces various aspects of museum operations, such as organization, financing, curation, exhibits, public interpretation, and conservation of collections. Emphasizes ethnographic and archaeological collections. May be repeated for different topics. *Not open to* students who have credit in ANTH 377.

**580 Topics in Archaeology. (3)** Surveys archaeology of a selected region (e.g., Southwest) or focuses on a specialized area. May be repeated for different topics.

A total of 6 hours of credit may be earned, but no more than 3 in any one semester or term.

**581 Culture, Economy, and Development. (3)** Concerned with a culturally embedded view of allocation, conversion, production, distribution, and consumption of resources. Emphasizes economic development in third- and fourth-world countries both from theoretical and applied perspectives. *Not open to* students who have credit in ANTH 481.

**582** Native Americans of the American Southwest. (3) Surveys prehistoric, historic, and contemporary cultures of selected Southwest Native American groups. Emphasizes culture-specific solutions to problems perceived in their relationship to their natural and social environments.

Not open to students who have credit in ANTH 482.

**590 Topics in Cultural Change.** (3) Surveys from various perspectives the major concepts and processes of culture change, including globalization and its effects on cultures and individuals.

A total of 6 hours of credit may be earned, but no more than 3 in any one semester or term. *Not open to* students who have credit in ANTH 460.

**600 Graduate Studies Seminar.** (1) Introduction to the nature, purpose, and practice of scholarly inquiry in academic and applied environments. Includes exposure to major literature and research resources in the field, familiarization with professional culture and faculty resources, individual program design, and thesis planning.

A total of 2 hours of credit may be earned, but no more than 1 in any one semester or term.

**601 Scope of Cultural Anthropology. (3)** Overview of theory in cultural anthropology and its application to various conditions of recent and contemporary human society and culture.

*Prerequisite:* undergraduate anthropology major or minor, admission to anthropology graduate program or permission of the instructor.

**603** Scope of Archaeology. (3) Overview of current archaeological research foci and interpretive frameworks in their historical context. Considers the relationship of archaeology to the other subdisciplines of anthropology and broader anthropological concerns.

*Prerequisite:* undergraduate anthropology major or minor, admission to anthropology graduate program or permission of the instructor.

# **605 Scope of Biological Anthropology. (3)** Survey of the basic methods and theories of biological anthropology.

*Prerequisite:* undergraduate anthropology major or minor, admission to anthropology graduate program or permission of the instructor.

#### 690 Independent Study in Anthropology.

(1-3) Topics to be chosen and investigated in consultation with the instructor with special competence in the subject involved.

Prerequisite: permission of the department chairperson.

A total of 6 hours of credit may be earned, but no more than 3 in any one semester or term.

**695 Research Methods in Anthropology.** (3) An opportunity to use research techniques appropriate to one or more subfields of anthropology in developing a research model, gathering and analyzing data, and organizing the material in a research paper or report.

**696 Internship in Anthropology. (3-6)** On-the-job experience practicing anthropology for a period of five to ten weeks with an institution or agency.

A total of 6 hours of credit may be earned.

# BIOLOGY

<u>www.bsu.edu/biology</u> Cooper Science Complex 121, 765-285-8820

#### PROGRAMS

Master of arts (MA) in biology; master of science (MS) in biology; doctor of education (EdD) in science education and doctor of philosophy (PhD) in environmental science. Graduate minors in biology are also offered at the master's level. A biotechnology certificate is also available. The science and general science program requirements may be found in the Science section, page 180.

See the Science listing under the College of Sciences and Humanities, page 180, for the doctoral programs in science education and philosophy in science.

#### **MASTER'S PROGRAMS**

#### **Admission requirements**

Applicants must meet the admission requirements of the Graduate School and submit scores from the Graduate Record Exam (GRE). Students should have good backgrounds in the life sciences, chemistry, mathematics, and physics and baccalaureate degrees with majors or minors in biology or the equivalent. Exceptions may be made by petition to the department. Students entering without adequate background are expected to make up the deficiencies during their first year.

#### **Professionalization of a Teaching License**

Any of the master's programs may be used to convert a standard-grade teaching license to a professionalgrade teaching license. Teachers working toward professional certification must complete a 9-hour professional education component, which includes at least one of the following: BIO 691, 694, PHYCS 691, or SCI 696. The BIO, PHYCS, or SCI hours may count toward the major area, the other hours as minor and elective hours toward the total of 30 hours.

# MASTER OF ARTS IN BIOLOGY

Designed to strengthen the student's background in biological sciences and related disciplines through course work at the graduate level; there is no research thesis requirement. Prepares students for jobs in biomedical laboratories, natural resource management agencies, scientific supply firms, environmental consulting firms, and scientific publishing firms, as well as for further education.

#### **Degree requirements**

PREFIX NO SHORT TITLE CR HRS

Approved courses from BIO, BIOT, BOT, SCI, and ZOOL CRPRJ 698 Creat Proj (3 or 6) or RES 697 Research Ppr (1-3) or BIOT 596 Res Des/Pres (2) and BIOT 590 Recomb Techn (3) or SCI 699 Res Mth Ed (3) 16-30 Minors and electives 0-14

30 hrs

Minors are optional, but if taken must include at least 8 hours of courses approved by a designated advisor from the minor area and the biology department.

## MASTER OF SCIENCE IN BIOLOGY

Includes both graduate course work and extensive research experience culminating in a research thesis. It is designed to prepare students for further study at the doctoral level, but graduates may also find employment in research-oriented activities of government agencies or private business firms.

#### **Degree requirements**

PREFIX NO SHORT TITLE CR HRS

Major requirements Approved courses from BIO, BOT, SCI, ZOOL THES 698 Thesis (1-6) 16-30 Minors and electives

0-14

30 hrs

Minors are optional, but if taken must include at least 8 hours of courses approved by a designated advisor from the minor area and the biology department.

# **GRADUATE MINOR IN BIOLOGY**

Requires 8 or more hours of approved BIO, BOT, and ZOOL courses.

# **BIOTECHNOLOGY CERTIFICATE**

PREFIX	NO	SHORT TITLE	CR HRS
BIOT	590	Recomb Techn	3
	591	Th/App PCR	3
	592	Prot Iso Ana	3
	593	Prof Dev	1
	594	Cell Culture	2
	595	Seq/Bioinfo	2
	596	Res Des/Pres	2

Electives

6-7 hours from

BIO 546 App Microbio (3)

- 548 Biometry (3)
- 552 Adv Genetics (3)
- 553 Human Genetc (3)
- 554 Genomes (3)
- 556 Cancer Bio (3)
- 557 Molecular (4)
- 570 Develop Biol (4)
- 631 Virology (4)
- 641 Med Bact (3) 6-7

1-6 hours from

BIO	669	Intern Bio (1-6)	
	694	Pract Sci Ed (1-6)	
	697	Research (1-3)	
RES	697	Research Ppr (1-3)	1-6

23-29 hrs

# **BIOLOGY (BIO)**

#### 501 Developments in Modern Biology.

(3-6) Stresses recent discoveries in biology and integrates and enhances understanding of basic principles of the discipline.

A total of 6 hours of credit may be earned.

**516 Population Ecology. (3)** Presents fundamental principles of population growth and regulation, including both with-species and between-species interaction. Implications for over-population, endangered species, and pest and game management are discussed. Laboratory includes both experimental studies and computer simulation exercises.

*Prerequisite:* BIO 216. *Not open to* students who have credit in BIO 416.

**520 Field Biology of Distant Areas. (3-12)** The species peculiar to selected geographic areas. Ecology, flora, and fauna. Travel may be by air. Seminars may be scheduled regularly throughout the course. Registration fee may include travel charges as well as the general fee.

Prerequisite: permission of the department chairperson.

A total of 12 hours of credit may be earned.

**540 Evolution.** (3) Principles, evidence, and the historical context of modern evolution theory. Some attention will be given to the origin of life and the evolution of plants and animals. *Not open to* students who have credit in BIO 440.

**546 Applied Microbiology.** (3) Study of microorganisms that effect beneficial and detrimental changes in foods (including milk and milk products) and industrial fermentations.

*Prerequisite:* BIO 313 or permission of the department chairperson. *Not open to* students who have credit in BIO 446.

**548 Biometry. (3)** Principles and applications of statistics to biological problems. The use of parametric and nonparametric tests of significance in the analysis of data and the interpretation of experiments. *Prerequisite:* MATHS 108 or its equivalent or permission of the department chairperson. *Not open to* students who have credit in BIO 448.

**552** Advanced Genetics. (3) Bacterial and eukaryotic genetics with emphasis on recent developments in molecular genetics. Topics include alternative structures of DNA, mechanisms of DNA replication, mutagenesis, DNA rearrangements, regulation of gene expression, RNA processing, and molecular and mutagenetic analysis of the cell cycle.

Prerequisite: BIO 214; CHEM 231.

Not open to students who have credit in BIO 452.

**553 Human Genetics and the Problems of Humankind.** (3) Current developments in human heredity. Human chromosome aberrations. DNA, the genetic code, and mutations. Consanguineous marriages and genetic defects. Mendelian principles applied to humans. Pedigrees and probability. Genetic screening and counseling. Social, ethical, and legal problems and advances in genetics.

*Prerequisite:* BIO 214 or permission of the instructor or department chairperson. *Not open to* students who have credit in BIO 453.

**554 Development and Evolution of Genomes: Genomics and Proteomics. (3)** Analysis of the development, expression, and evolution of genomes through the examination of genomics and proteomics. Attempts to explore the theoretical basis of developing technologies to provide models for application to current questions in biological systems from the cellular or organismal levels by treatment of the genome as a system.

*Prerequisite:* BIO 214, 215; or permission of the instructor. *Not open to* students who have credit in BIO 454.

**556 Cancer Biology.** (3) Examination of the biological basis of cancer, discussion of related contemporary issues, and overview of recent advances in cancer research. Emphasis on cancer

progression, tumor production, etiology/epidemiology, prevention, modern therapies, and patient management.

Prerequisite: BIO 215, its equivalent, or permission of the department chairperson.

**557 Molecular Biology.** (4) Structure and function of macromolecules in living things. Emphasizes threedimensional structures; models for enzyme mechanisms, DNA replication; protein synthesis and membrane function; and applications of biotechnology.

*Prerequisite:* BIO 215 or the equivalent, or permission of the department chairperson. *Not open to* students who have credit in BIO 457.

**560** Microtechniques. (4) A lecture/lab course in the preparation of biological material for microscopic examination in teaching, research, and clinical applications. Emphasizes preparation of smears, squashes, whole mounts, paraffin, and frozen plant and animal sections, and photomicrography.

Not open to students who have credit in BIO 460.

**570 Developmental Biology.** (4) Recent advances and theories in early embryogenesis and developmental biology. Major emphasis on genetic and molecular mechanisms operating during developmental phenomena. Topics include fertilization, mosaic versus regulative development, regulation of gene expression, patterning, germ line and sex determination, and neoplasia. Lecture and laboratory.

Prerequisite: BIO 215 or equivalent or permission of the department chairperson.

Not open to students who have credit in BIO 470.

**580 Limnology.** (3) The physical, chemical, and biological characteristics of inland waters. Laboratory time and several field trips will be devoted to exploring techniques for the evaluation of representative aquatic ecosystems.

*Prerequisite:* BIO 216 or permission of the department chairperson. *Not open to* students who have credit in BIO 480.

**582** Aquatic Microbiology. (3) Microorganisms indigenous to nonpolluted and polluted aquatic ecosystems. Emphasizes nutrient cycling and the use of microorganisms as indicators of pollution. Morphology, physiology, and ecology of specific organisms. Lecture and laboratory.

Prerequisite: BIO 313.

Not open to students who have credit in BIO 482.

**583 Marine Biology.** (3) Introduction to marine environments. Properties of seawater, hydrodynamics. Phyto-plankton and benthic plants. Primary production, nutrient cycles. Marine animals, surveys of major taxa. Adaptations for life on the bottom, open water, intertidal zones, estuaries, and abyssal regions. Problems of overexploitation and pollution.

Not open to students who have credit in BIO 483.

**592 Bioethical Decision Making. (3)** Development of decision-making skills through the analysis and personal resolution of bioethical problems created by the application of new biological and biomedical knowledge and technologies.

Not open to students who have credit in BIO 492.

**628 Readings in Biology. (1-3)** Directed readings for majors in biology. Individualized program of readings developed under the supervision of a faculty member.

*Prerequisite:* permission of the department chairperson.

A total of 3 hours of credit may be earned.

**629 Seminar in Biology.** (1) Review and discussion of the literature related to selected topics of current interest in biological research.

Prerequisite: permission of the department chairperson.

A total of 2 hours of credit may be earned, but no more than 1 in any one semester or term.

**631 Virology.** (4) An in-depth study of viruses, including animal, plant, insect, and bacteria viruses. Topics include the physical and chemical properties of viruses, virus- host interactions, and pathogenesis. In addition to the lecture component, a weekly discussion of journal articles emphasizing virology-based experimental assays will also be required.

*Prerequisite:* cell biology and one course in microbiology, or by permission of the instructor or department chairperson. Familiarity with immunology is preferred.

**636 Immunology. (4)** A study of the components of the immune system and immune responses with particular emphasis on immune-related diseases. Topics include hematopoiesis, cellular interactions, immunochemistry, immunogenetics, and immune regulation and tolerance. The lab component will emphasize immunology-based assays and include journal article discussions concerning immunology topics.

*Prerequisite:* cell biology and one course in microbiology, or by permission of the instructor or department chairperson.

**641 Medical Bacteriology. (3)** Study of pathogenic bacteria with emphasis on morphology and physiology. Laboratory techniques in culturing, isolating, and identifying bacteria.

Prerequisite: BIO 313; CHEM 231.

Not open to students who have credit in BIO 341.

**642 Medical Microbiology. (8)** Microbiology for medical students with consideration of bacteria, fungi, viruses, and parasites as agents in human disease and the immunological and serological aspects of the host-parasite relationship.

*Open only to* medical students or by permission of the department chairperson.

**653 Medical Genetics. (2)** Genetics for medical students: basic genetic principles, human cytogenetics, molecular genetics, genetic epidemiology; probability, population and quantitative (multifactorial) genetics; dermatoglyphics, etiology of birth defects, inborn metabolic disorders, genetic screening and counseling, genetics of mental illness and cancer, pharmacogenetics, immunogenetics, and genetic engineering.

Open only to medical students or by permission of the department chairperson.

**655** Cell Biology. (4) Biology of the cell, including cell morphology, bioenergetics, enzyme function, cell environment, membrane structure and function, cell metabolism, and cell differentiation and growth.

Prerequisite: CHEM 360.

Not open to students who have credit in BIO 215.

**656 (518) Ecosystem Ecology. (3)** Principles and application of ecosystem ecology. Provides students with an understanding of concepts in modern ecosystem ecology and with an in-depth analysis of ecosystem components, processes, and factors that control them.

Prerequisite: BIO 216 or the equivalent, or permission of the instructor.

**657 Multivariate Analysis of Environmental Data. (3)** Introduction to multivariate statistical techniques and technological tools necessary to evaluate the literature and to carry out original research in the environmental sciences.

Prerequisite: BIO 448 or 548 or the equivalent, or permission of the instructor.

**669 Internship in Biology. (1-6)** Paid, supervised field and laboratory experience in public or private agencies (or in the Department of Biology). Training involves application of biological principles in the work environment.

*Prerequisite:* permission of the department chairperson. A total of 6 hours of credit may be earned.

**691 Developments in Biology Education. (3)** Origin, content, emphasis, and objectives of recent curriculum developments and philosophical approaches to teaching science in the secondary school. Student activities include presentation of current topics and creation of instructional materials that incorporate the most current techniques.

Prerequisite: an undergraduate major or minor in science.

**694 Practicum in Science Education.** (1-6) Science curricula and instruction in classroom situations. Needs assessment in science education from the point of view of inservice teachers and their students. Staff consultation in implementation of improved science programs.

Prerequisite: permission of the department chairperson.

A total of 6 hours of credit may be earned.

**697 Research in Biology. (1-3)** Independent research for biology majors at the master's level. Students' research projects must be developed in consultation with a faculty member. As much as 3 hours of credit may be applied toward a master's degree.

Prerequisite: permission of the department chairperson.

A total of 3 hours of credit may be earned.

**796 Research in Biology.** (1-6) Independent research for biology majors at the doctoral level. Students' proposed research projects must be developed in consultation with a faculty member.

Prerequisite: permission of the department chairperson.

A total of 8 hours of credit may be earned, but no more than 6 in any one semester or term.

#### **BIOTECHNOLOGY (BIOT)**

**590 Introduction to Recombinant DNA and RNA Techniques.** (3) Study of the fundamental methods and approaches used in biotechnology with experiences in recombinant DNA and RNA techniques. Emphasis on theory and practice of commonly used scientific techniques, experimental design, and reading and analysis of scientific literature.

Prerequisite: BIO 215 or 655.

Not open to students who have credit in BIOT 490.

**591 Theory and Applications of the Polymerase Chain Reaction.** (3) Study of the theory of the polymerase chain reaction and its standard applications in research. Emphasis on experimental design and optimization of reactions, applications in DNA and RNA analysis, differential display, site-directed mutagenesis, and subcloning of PCR products.

Prerequisite: BIO 215 or 655.

Not open to students who have credit in BIOT 491.

**592 Protein Isolation and Analysis. (3)** Study of the theory and application of techniques involved in protein isolation, characterization, and analysis. Emphasis on understanding principles of protein purification, laboratory experiences in protein separation, detection and analysis of structure function relationships.

Prerequisite: BIO 215 or 655.

Not open to students who have credit in BIOT 492.

**593 Professional Development in Biotechnology.** (1) Emphasizes curriculum vita development. Provides employment counseling, discussion of job ethics and values, information on laboratory set-up, and job interview strategies.

Not open to students who have credit in BIOT 493.

**594 Cell Culture Techniques. (2)** Study of the practice and theory of cell and tissue culture. Emphasis on the application of basic concepts and techniques to the in vitro culture of many different cell types. *Prerequisite:* BIOT 590.

Not open to students who have credit in BIOT 494.

**595 DNA Sequencing and Bioinformatics. (2)** Covers the determination of DNA nucleotide sequence and Internet/software utilization of DNA and protein databases for sequence analysis.

Prerequisite: BIOT 590.

Not open to students who have credit in BIOT 495.

**596 Research Design and Presentation. (2)** Emphasizes improvements in oral and written communication skills, and development of an independent research proposal.

Prerequisite: BIOT 590.

Not open to students who have credit in BIOT 496.

## **BOTANY (BOT)**

**540 Taxonomy of Vascular Plants. (4)** Identification, use, and care of native and ornamental trees, shrubs, vines, and herbaceous plant material. The use of botanical keys, manuals, and texts in the identification of plant taxa.

*Prerequisite:* BIO 112 or permission of the department chairperson. *Not open to* students who have credit in BOT 440.

**542 Economic Botany.** (3) The cultivation, processing, environmental requirements, and use of plants and plant derivatives for food, drugs, dwellings, clothing, and power.

Not open to students who have credit in BOT 442.

**544 Plant Propagation and Management. (3)** Practical experience in the different methods of plant propagation, care, and cultivation for use in the home, school, garden, and greenhouse. Diseases, pathogens, and pests of the plant.

**546 Medical Mycology. (3)** Study of fungi with emphasis on pathogenic forms. Methods of identification of fungi will be discussed along with morphology and biochemistry of fungi.

Prerequisite: BIO 313.

Not open to students who have credit in BOT 446.

**551 Plant Physiology. (4)** An introductory treatment of the physiological activities of green plants with emphasis on plant growth substances, photosynthesis, and intermediate metabolism.

Prerequisite: BIO 112; CHEM 231.

Not open to students who have credit in BOT 451.

**560 Plants and Their Allies.** (4) Evolutionary-phylogenetic survey of plant forms. Includes bacteria, algae, fungi, bryophytes, and vascular plants. Emphasizes comparative morphology and anatomy, reproductive structures, cycles, and adaptations to varying habitats.

Prerequisite: BIO 111, 112.

**570 Dendrology. (3)** The identification and site characterization of woody plants with emphasis on midwestern tree species. Use of botanical features and keys in field identification. Correlation of species with site conditions, plant diseases, climatic parameters, associate species, and geographical distribution.

Prerequisite: BIO 112 or permission of the department chairperson.

Not open to students who have credit in BOT 470.

**580 Plant Ecology.** (3) Factors affecting the distribution and abundance of plants. Patterns, structure, and development of plants at the individual, population, and community levels. Laboratory provides experience with ecological experimentation at the physiological, population, and community levels.

Prerequisite: BIO 216 or permission of the instructor.

**581 Aquatic Botany.** (4) The collection and identification of nonvascular and vascular plants from fresh water ecosystems. Emphasizes morphology, physiology, and ecology of these plants to explain their distribution in nature. Class project and field trips may be used to demonstrate ecological relationships.

Prerequisite: BIO 112 or permission of the department chairperson.

Not open to students who have credit in BOT 481.

## SCIENCE (SCI)

**501 Electron and Confocal Microscopy. (3)** Introduction to the techniques and theory of electron and confocal microscopy. Emphasizes basic procedures employed in specimen preparation, production of micrographs and operation of the transmission, scanning, and confocal microscopes.

**690 Workshop in Science Education.** (1-12) Practical experience with teaching science at specific level (early childhood, elementary, middle, secondary, or higher education) and/or specific topic (e.g., chemistry or geology). May be repeated for different level and/or topic.

*Prerequisite:* teaching experience or certification or permission of the instructor. A total of 24 hours of credit may be earned, but no more than 12 in any one semester or term.

**692 Topics in the History and Nature of Science.** (3) Examination of the historical development of science from a wide variety of perspectives. Roles of scientists, society, culture, and gender in the creation and validation of scientific knowledge. Implications of the Nature of Science for science teaching and learning.

**695** Advanced Teaching Methods in Science. (3-6) Recent developments in science teaching at specific level (early childhood, elementary, middle, secondary, or higher education) and/or specific topic (e.g., biology or physics). May be repeated for different level and/or topic.

*Prerequisite:* teaching experience or certification or permission of the instructor.

A total of 6 hours of credit may be earned.

**696 Current Issues in Science Education.** (**3-6**) Current research and theory of teaching science at specific level (early childhood, elementary, middle, secondary, or higher education) and/or specific science topic (e.g., chemistry or geology). May be repeated for different level and/or topic.

Prerequisite: permission of the instructor.

A total of 6 hours of credit may be earned.

**699 Research Methodology in Science Education.** (3) Identification of research problems in science and science education. Introduction to types of research, research design, and grant-writing. Review of literature pertinent to a special topic of student interest. Development of a research proposal.

*Prerequisite:* permission of the department chairperson.

790 Internship in Science Education. (1-4) Supervised experience in instruction of science or science education courses.

Prerequisite: permission of the department chairperson. A total of 4 hours of credit may be earned.

# **ZOOLOGY (ZOOL)**

532 Invertebrate Zoology. (4) Comparative morphology, physiology, ecology, life histories, and phylogeny of invertebrate animal phyla.

Prerequisite: BIO 111, 112, or permission of the department chairperson.

Not open to students who have credit in ZOOL 432.

540 Ornithology. (3) The study of birds including identification, systematics, anatomy, physiology, life histories, ecological relationships, and conservation. Fieldwork in addition to regular laboratory periods may be required.

Not open to students who have credit in ZOOL 440.

541 Entomology. (3) Anatomy, physiology, taxonomy, life histories, habits, and adaptations of insects. Prerequisite: BIO 111, 112, or permission of the department chairperson. Not open to students who have credit in ZOOL 441.

**544 Ichthyology.** (3) The study of fish with emphasis on identification, classification, anatomy and physiology, and ecology. Emphasizes Indiana species but includes other important species.

Prerequisite: BIO 111, 112, or permission of the department chairperson. Not open to students who have credit in ZOOL 444.

**545 Herpetology.** (3) Introduction to the biology of amphibians and reptiles, including their origin, anatomy, physiology, classification, behavior, and ecology. Through extensive field trips, the laboratory will emphasize identification and observation of amphibians and reptiles in their natural habitats.

Prerequisite: BIO 112.

Not open to students who have credit in ZOOL 445.

546 Mammalogy. (3) The evolutionary origin, characteristics, and distribution of recent mammals. The economic relationships of mammals. The collection and preservation of specimens. May require additional fieldwork.

Not open to students who have credit in ZOOL 446.

565 Fishery Resources Management. (3) The relationship of fisheries to other natural resources; a survey of aquatic habitats and the characteristics of fish that affect their management; basic principles, practices, and techniques of management of inland waters for fish production.

Prerequisite: BIO 216 or permission of the department chairperson.

Not open to students who have credit in ZOOL 465.

**583 Wildlife Biology.** (3) The identification, population dynamics, and geographic distribution of wildlife species with particular emphasis on those of the United States. The harvest and management of wildlife. May require additional fieldwork.

Prerequisite: BIO 216 or permission of the department chairperson.

Not open to students who have credit in ZOOL 483.

**584 Aquatic Entomology.** (3) Immature and adult stages of aquatic insects, including collecting techniques, identification, ecological requirements, morphology, and evolutionary adaptations to lentic and lotic conditions. Emphasizes aquatic insects as indicators of environmental quality and stress.

Prerequisite: ZOOL 541 or permission of the department chairperson.

Not open to students who have credit in ZOOL 484.

**670 Field Zoology. (3)** The field study of animals—terrestrial and aquatic, invertebrate and vertebrate, microscopic and macroscopic—with emphasis on the collection and identification of noninsect invertebrates.

**682** Animal Ecology. (3) The composition, development, dynamics, and geographic distribution of animal communities. The relationships between animals and the physical, chemical, and biotic elements of the environment. Includes physiological ecology and ethology. Field studies of animal communities.

# CHEMISTRY

<u>www.bsu.edu/chemistry</u> Cooper Science Complex 305, 765-285-8060

## PROGRAMS

Master of arts (MA) in chemistry and master of science (MS) in chemistry

See the Science listing under the College of Sciences and Humanities, page 180, for doctoral programs in science education and philosophy in environmental science.

#### **Admission requirements**

Applicants must meet the admission requirements of the Graduate School and should have satisfactory Graduate Record Examination (GRE) verbal and quantitative scores.

## MASTER OF ARTS IN CHEMISTRY

PREFIX NO SHORT TITLE CR HRS

Chemistry option

CHEM	500	Chem Comunic	1
	563	Prn Biochm 1	3
	626	Adv Analytic	3
	636	Adv Org Chem	3
	646	Adv Phy Chem	3
	651	Adv Inorgan	3
	673	Seminar	1
Graduate	e chem	istry courses	
approved	l by th	e graduate advisor	9
		-	
Descorol	roqui	romonts	

Research requirements 4 hours from CHEM 670 Resrch Chem (1-7)

	696	Resrch Meth (2)
DEC	607	December Den (1.2)

DEC	<b>CO7</b>	$\mathbf{D}$ $1$ $\mathbf{D}$ $(1$ $2)$	4
<b>RES</b>	697	Research Ppr (1-3)	4

30 hrs

Chemical Education option

CHEM	500	Chem Comunic	1
	563	Prn Biochm 1	3
	626	Adv Analytic	3
	636	Adv Org Chem	3
	646	Adv Phy Chem	3
	651	Adv Inorgan	3
	673	Seminar	1

Graduate chemistry courses approved by the graduate advisor

9

Research requirements

4 hours f	rom		
CHEM	671	Resrch Ch Ed (1-7)	
	696	Resrch Meth (2)	
RES	697	Research Ppr (1-3)	4

30 hrs

#### MASTER OF SCIENCE IN CHEMISTRY

PREFIX NO SHORT TITLE CR HRS

Chemistry option

CHEM	500	Chem Comunic	1
	563	Prn Biochm 1	3
	626	Adv Analytic	3
	636	Adv Org Chem	3
	646	Adv Phy Chem	3
	651	Adv Inorgan	3
	673	Seminar	1

Research requirements

CHEM	670	Resrch Chem (1-7)	7	
THES	698	Thesis (1-6)	6	

THES	098	1 nesis (1-0)	C

30 hrs

#### Chemical Education option

500	Chem Comunic	1
563	Prn Biochm 1	3
626	Adv Analytic	3
636	Adv Org Chem	3
646	Adv Phy Chem	3
651	Adv Inorgan	3
	500 563 626 636 646 651	<ul> <li>500 Chem Comunic</li> <li>563 Prn Biochm 1</li> <li>626 Adv Analytic</li> <li>636 Adv Org Chem</li> <li>646 Adv Phy Chem</li> <li>651 Adv Inorgan</li> </ul>

673 Seminar

**Research** requirements CHEM 671 Resrch Ch Ed (1-7) 7 THES 698 Thesis (1-6)

30 hrs

6

1

These programs are designed for students who hold bachelor of science or bachelor of arts degrees in chemistry, including at least one year of calculus-based physical chemistry. Students with substantial backgrounds (e.g., those who have completed at least ACS-certified bachelor's degrees or work beyond the bachelor's level) may have one or more of the core course requirements waived, but the minimum number of 30 hours required for graduation still applies. These students should discuss the possibilities with the chemistry graduate advisor.

Students with substantial chemistry backgrounds but who have undergraduate degrees in such other disciplines as biology, medical technology, premedicine, or predentistry may be admitted to the graduate program to begin some graduate course work while making up undergraduate deficiencies. However, courses taken to remove undergraduate deficiencies cannot be applied to total graduate hours. These students should discuss their situations with the chemistry graduate advisor to determine whether their backgrounds are sufficient to begin graduate work in chemistry.

#### **CHEMISTRY (CHEM)**

500 Chemical Communications. (1) Use of scientific literature, sources, and classification systems, and current and retrospective searches in the specialized branches of chemistry.

Prerequisite: 20 hours of chemistry or permission of the department chairperson. Not open to students who have credit in CHEM 400.

**520 Chemical Instrumentation 1. (3)** Theoretical principles and applications of selected spectroscopic, electro chemical, and chromatographic methods, with illustrative experiments. Two hours of lecture and one three-hour laboratory period weekly.

Prerequisite: CHEM 225, 344 or 340 or permission of the department chairperson. Not open to students who have credit in CHEM 420.

521 Chemical Instrumentation 2. (3) Advanced treatment of selected topics in spectroscopy, electrochemistry, and chromatography. Introduction to mass spectroscopy, nuclear methods, and thermal and surface analysis. Three hours of lecture weekly.

Prerequisite: CHEM 520 or permission of the department chairperson.

**525 Instrumental Methods of Analysis. (3)** Practical applications of modern chemical instrumentation: electrometric, chromatographic, and spectroscopic methods. For chemical/medical technologists or departmental minors. Two hours of lecture and one three-hour laboratory weekly.

Prerequisite: CHEM 225.

Not applicable to MS or MA degree programs in chemistry. Not open to students who have credit in CHEM 325.

530 Organic Laboratory Techniques. (2) Laboratory course that includes multi-step syntheses of organic compounds, their isolation, purification, and characterization using modern spectroscopic and chromatographic techniques. Six hours of laboratory weekly.

Prerequisite: CHEM 232 or its equivalent.

Not open to students who have credit in CHEM 430.

**540 Selected Principles of Physical Chemistry. (3)** Introduction to the properties of solids, liquids, gases, and solutions and to the basic concepts of thermodynamics and kinetics. Especially for premedical, biology, and general science majors, chemistry teaching majors, and chemistry minors. Two hours of lecture and one three-hour recitation/laboratory period weekly.

Prerequisite: CHEM 225; MATHS 161.

Not open to students who have credit in CHEM 340, 344, or 544.

**544 Physical Chemistry 1. (4)** Thermodynamic and structural description of chemical processes and properties of solids, liquids, gases, and solutions. Three hours of lecture and one three-hour laboratory period weekly.

Prerequisite: CHEM 232 or 235; MATHS 166; one year of college physics.

Not open to students who have credit in CHEM 344.

Cannot be used for credit by a candidate for the master of science degree with chemistry as a major.

**545** Physical Chemistry 2. (4) Continuation and extension of CHEM 544. Topics include reaction kinetics, theoretical facets of quantum mechanics, and spectroscopy. Three hours of lecture and one three-hour laboratory period weekly.

Prerequisite: CHEM 344 or 544.

Not open to students who have credit in CHEM 345.

Cannot be used for credit by a candidate for the master of science degree with chemistry as a major.

**550 Inorganic Chemistry. (4)** Chemistry of the elements, including the relationships of chemical properties and atomic and molecular structure, chemical bonding, acid-base theories, chemical periodicity, and modern theories of coordination compounds. Four hours of lecture weekly.

*Prerequisite:* CHEM 232 or 235 or 360; MATHS 161 or 165. *Not open to* students who have credit in CHEM 450.

**560 Essentials of Biochemistry. (4)** Organic chemistry of carboxylic acids, amines, and their derivatives; biochemistry of proteins, carbohydrates, lipids, and nucleic acids; metabolism and the regulation of metabolic processes. For students in life sciences, dietetics, and medical technology. Three hours of lecture and one three-hour laboratory session weekly.

Prerequisite: CHEM 231 or the equivalent.

Not applicable to MS or MA degree programs in chemistry.

Not open to students who have credit in CHEM 360 or 463 or 563.

**563 Principles of Biochemistry 1. (3)** Chemistry of proteins, enzymes, nucleic acids, carbohydrates, and lipids. For chemistry, life sciences, and premedicine majors. Three hours of lecture weekly.

Prerequisite: CHEM 232 or 235.

Not open to students who have credit in CHEM 463.

**564 Principles of Biochemistry 2. (3)** Continuation and extension of CHEM 563 including biological oxidations and energy transfers; metabolism of carbohydrates, lipids, proteins, and nucleic acids; and regulation of metabolic processes. Three hours of lecture weekly.

Prerequisite: CHEM 463 or 563.

Not open to students who have credit in CHEM 464.

**575 Exploration of Selected Topics in Chemistry. (1-3)** Discussion or written reports or both in advanced special topics in or related to chemistry. Examples are topics in neurochemistry, physical organic, chemical synthesis, kinetics, spectroscopy, etc.

Prerequisite: permission of the department chairperson.

A total of 6 hours of credit may be earned, but no more than 3 in any one semester or term.

**626** Advanced Analytical Chemistry. (3) Survey of modern analytical chemistry. Topics include sampling, wet chemical techniques, nonaqueous systems, and contemporary research and applications in chromatography, spectroscopy, and electrochemistry. Three hours of lecture weekly.

Prerequisite: CHEM 225 or the equivalent.

**627** Analytical Chemistry in the Environmental Sciences. (3) Survey of the development and implementation of modern analytical methods, particularly as they apply to the study of environmentally relevant systems. Techniques include gas and liquid chromatography, mass spectrometry, UV-visible absorption and fluorescence spectroscopy, electrochemistry and elemental analysis techniques such as AAS and ICP.

Prerequisite: permission of the department chairperson.

**636** Advanced Organic Chemistry. (3) Topics include nomenclature, bonding, acids and bases, sterochemistry, structure- reactivity relationships, and mechanisms of important reactions. Introduction to synthesis, the disconnect approach, synthons, protecting groups, and functional group interconversions.

Prerequisite: CHEM 232 or 235 or the equivalent.

**646** Advanced Physical Chemistry. (3) Survey of physical chemical principles with emphasis on practical applications. Topics include thermodynamics, reaction kinetics, and selected quantum chemical applications.

Prerequisite: CHEM 345 or its equivalent.

**651** Advanced Inorganic Chemistry. (3) Continuation of CHEM 550. Current theories of bonding in coordination chemistry. Descriptive and theoretical treatments of the chemistry and structure of transition metal complexes, organometallic compounds, fluxional molecules, and metal clusters; the importance of metals in biological systems. Three hours of lecture weekly.

Prerequisite: CHEM 450, 340 or 344.

**667 Medical Biochemistry. (6)** Chemistry of major cellular constituents; enzymes as the catalysts of intracellular chemical reactions with emphasis on underlying principles of physical and organic chemistry. Intermediary metabolism of carbohydrates, lipids, amino acids, and nucleotides; modern techniques employed in the study of metabolic processes; biosynthesis and degradation of intracellular components; hormonal regulation of metabolism.

Prerequisite: admission to the medical education program.

**670 Research in Chemistry. (1-7)** Original work at the molecular level on projects based in the current scientific literature. The projects will be directed by graduate faculty and will typically involve aspects of ongoing research.

Prerequisite: permission of the department chairperson.

A total of 7 hours of credit may be earned.

#### 671 Research in Chemical Education.

(1-7) Original work based on the current science education literature. Projects will be directed by graduate faculty and may involve conducting surveys, developing new instructional materials or methods, or evaluating the effectiveness of technology-based teaching.

Prerequisite: permission of the department chairperson.

A total of 7 hours of credit may be earned.

**673 Seminar in Chemistry.** (1) Critical examination and discussion of recent experimental and theoretical developments in chemistry.

Prerequisite: CHEM 400 or 500; permission of the department chairperson.

**675** Advanced Topics in Chemistry. (1-3) Discussion, experimentation, or both in specialized topics for the qualified advanced student. Information concerning specific topics offered during a given semester may be obtained from the departmental office. Lecture and laboratory schedules appropriate to the topics offered.

*Prerequisite:* permission of the department chairperson. A total of 3 hours of credit may be earned.

**690** Contemporary Instruction and Curricula in Chemistry. (2-4) Designed to make the inservice chemistry teacher familiar with management of large-group instruction, development and implementation of multimedia materials in instructional schemes, use of videotape in the laboratory, and facility design for modular and other systems. Field trips to nearby schools to study facility design may be included. Two hours of lecture weekly.

Prerequisite: permission of the department chairperson.

A total of 4 hours of credit may be earned.

**696 Chemistry Research Methods. (2)** Introduction to use of scientific literature, design of research experiments, specialized techniques, and writing skills endemic to the specialized fields of chemistry. Class and laboratory experience appropriate to students' specializations.

*Prerequisite:* CHEM 400 or 500; permission of the department chairperson.

**770 Research in Chemistry. (1-12)** In-depth original work at the molecular level on projects based in the current scientific literature. The projects will be directed by graduate faculty and will typically involve aspects of ongoing research.

*Prerequisite:* permission of the department chairperson. A total of 12 hours of credit may be earned.

## 771 Research in Chemical Education.

(1-12) In-depth original work based on the current science education literature. Projects will be directed by graduate faculty and may involve conducting surveys, developing new instructional materials or methods, or evaluating the effectiveness of technology-based teaching.

Prerequisite: permission of the department chairperson.

A total of 12 hours of credit may be earned.

**773 Chemistry and Chemical Education Seminar.** (1-3) In-depth analyses of recent trends and developments in chemistry or chemical education. Seminar participants report on assigned topics to departmental groups.

Prerequisite: permission of the department chairperson.

A total of 3 hours of credit may be earned.

# **COMPUTER SCIENCE**

<u>www.bsu.edu/cs</u> Robert P. Bell Building 455, 765-285-8641

## PROGRAMS

The master of science (MS) degree is primarily for students with undergraduate degrees in computer science who plan to undertake further graduate study or apply computer science in a variety of fields. A minor in computer science is also offered.

See the Science listing under the College of Sciences and Humanities, page 180, for the doctoral programs in science education and philosophy in environmental science.

#### **Admission requirements**

In addition to meeting the admission requirements of the Graduate School, applicants must have departmental approval for admission. Applicants must submit three letters of recommendation, a one-page statement of educational goals, and scores from the Graduate Record Examination (GRE). Students without an adequate computer science background will be required to take directed courses in which they earn an average grade of at least a *B*. No credit toward a degree will be granted for these courses.

## MASTER OF SCIENCE IN COMPUTER SCIENCE

Required mathematics background courses (unless the student has credit in equivalent courses). No graduate credit given, but a GPA of at least 3.0 is to be maintained.

4

PREFIX NO SHORT TITLE CR HRS

- MATHS 161 Appl Calc 1 (3)
  - 162 Appl Calc 2 (3)
  - 217 Lin Algebra (4)
  - 221 Pbty Stats (3)

Required computer science background courses (unless the student has credit in equivalent courses). No credit given toward the degree, but a grade of at least a *B* is to be earned in each course. CS = 120, Comp Sci 1

CS	120	Comp Ser I	4
	121	Comp Sci 2	4
	124	Discr Struct	3
	230	Org Arch	3
	324	Dsg Ana Algo	3
	335	Prog Lang	3

Thesis option

Required courses

1			
CS	570	Thy Cmptn 1	3
	670	Thy Cmptn 2	3
	689	Res Methods	3
	690	Software Eng	3
THES	698	Thesis (1-6)	6

15 hours of electives (including at least one 600-level course, other than CS 699)

CS	527	Networks (3)
	530	System Prog (3)
	536	Database Dgn (3)
	538	Graphics (3)
	539	Curr Tpcs (3-6)
	545	Hum-Comp Int (3)
	555	Data Mining (3)
	556	Image Proc (3)
	557	Appl Cryptog (3)
	576	Op Systems (3)
	636	Adv Db Sys (3)
	638	Topics Graph (3)
	639	Seminar (3)
	642	Simulations (3)
	665	Ap Comp Geom (3)
	668	Graph Algo (3)
	675	Model Check (3)
	678	Compil Const (3)
	699	Read Honor (3)
MATHS	562	Numer Anls 1 (3)

563 Numer Anls 2 (3) 15

33 hrs

Nonthesis option

**Required** courses CS

570	Thy Cmptn 1	3
670	Thy Cmptn 2	3
689	<b>Res Methods</b>	3
690	Software Eng	3

21 hours of electives (including at least two 600-level courses, other than CS 699)

- CS 527 Networks (3)
  - 530 System Prog (3)
  - 536 Database Dgn (3)
  - 538 Graphics (3)
  - 539 Curr Tpcs (3-6)
  - 545 Hum-Comp Int (3)
  - 555 Data Mining (3)
  - 556 Image Proc (3)
  - Appl Cryptog (3) 557
  - 576 Op Systems (3)
  - 636 Adv Db Sys (3)
  - Topics Graph (3) 638
  - Seminar (3) 639
  - 642 Simulations (3)
  - Ap Comp Geom (3) 665
  - 668 Graph Algo (3)
  - 675 Model Check (3)

678	Compil Const (3)
-----	------------------

699 Read Honor (3)

MATHS 562 Numer Anls 1 (3)

563 Numer Anls 2 (3) 21

33 hrs

#### MINOR IN COMPUTER SCIENCE

PREFIX NO SHORT TITLE CR HRS

12 hours from

CS 527 Networks (3) 530 System Prog (3) 536 Database Dgn (3) 538 Graphics (3) 545 Hum-Comp Int (3) 555 Data Mining (3) 556 Image Proc (3) 557 Appl Cryptog (3) 570 Thy Cmptn 1 (3) 576 Op Systems (3) 636 Adv Db Sys (3) Topics Graph (3) 638 Seminar (3) 639 642 Simulations (3) Ap Comp Geom (3) 665 668 Graph Algo (3) 670 Thy Cmptn 2 (3) 675 Model Check (3) 678 Compil Const (3) 689 Res Methods (3) 690 Software Eng (3) 699 Read Honor (3)

- MATHS 562 Numer Anls 1 (3)
  - 563 Numer Anls 2 (3) 12

# DOCTOR OF EDUCATION (EdD and PhD) WITH MAJOR IN COMPUTER SCIENCE

EdD program in science education and PhD program in philosophy in environmental science with computer science as the major area is available. See the Science listing on page 180 under the College of Sciences and Humanities for details.

## COGNATE IN THEORY OF COMPUTING

This cognate is aimed at the EdD in science candidate who already has the background course work in computer science that is required of all candidates entering the master of science degree program in computer science, as well as the relevant mathematical background prerequisites to the program.

<sup>12</sup> hrs

#### **Degree requirements**

PREFIX	NO	SHORT TITLE	CR HRS
CS	570 668	Thy Cmptn 1 Graph Algo	3
	670	Thy Cmptn 2	3

9 hrs

Electives (choose two courses for the 15-credit-hour cognate, or five courses for the 24-hour cognate.)

538 Graphics (3) CS

- 555 Data Mining (3)
  - 557 Appl Cryptog (3)
  - 638 Topics Graph (3)
  - 639 Seminar (3)
  - 642 Simulations (3)
  - 665 Ap Comp Geom (3)
  - 675 Model Check (3)
  - 678 Compil Const (3)
  - 699 Read Honor (3)
- MATHS 562 Numer Anls 1 (3)
  - 563 Numer Anls 2 (3)

## 6 or 15 hrs

Up to 9 hours of 500-level courses permitted on the 15-hour cognate; up to 12 hours of 500-level courses permitted on the 24-hour cognate.

A total of 9 hours of CS 699 may be earned for the 24-hour cognate and a total of 6 hours of CS 699 may be earned for the

15-hour cognate.

# PRE-MASTERS OF COMPUTER SCIENCE CERTIFICATE

PREFIX NO SHORT TITLE CR HRS

**Required** courses

CS	524	Dsg Ana Algo	3
	535	Prog Lang	3
	570	Thy Cmptn 1	3

#### Electives, 9 hours from CS

- 527 Networks (3)
  - 530 System Prog (3)
  - 536 Database Dgn (3)
  - 538 Graphics (3)
  - 545 Hum-Comp Int (3)
  - 547 Net Security (3)
  - 555 Data Mining (3)
  - 556 Image Proc (3)

576 Op Systems (3) 9

18 hrs

#### **COMPUTER SCIENCE (CS)**

**515 Game Programming. (3)** An introduction to game programming. Topics include active and passive rendering, sprite animation, collision detection, audio playback, input devices, deployment, and applications of artificial intelligence.

*Prerequisite:* CS 324. *Not open to* students who have credit in CS 315.

**517 Introduction to Programming. (3)** Software development using a high-level programming language (such as C++ or Java) for a wide range of information system applications. Structured programming, data types, functions, arrays, pointers, and recursion. Applications from areas of interest.

Not open to graduate majors in computer science.

**524 Design and Analysis of Algorithms. (3)** Topics include: analysis of algorithms; dynamic programming; probabilistic algorithms, examples of geometric, combinatorial and graph algorithms, pattern matching; introduction to NP-completeness. Hours do not apply to master's degree in computer science.

Prerequisite: CS 121 or equivalent and either MATHS 161 or 165 or equivalent.

**527 Internetworking.** (3) The hardware and software of computer networks and distributed processing. Develops the important design parameters and a general design methodology.

*Prerequisite:* CS 324. *Not open to* students who have credit in CS 327.

**530 System Programming. (3)** Considers the computer system from the points of view of its architecture, operating system, and applications. Topics include processor organization, peripheral devices, I/O programming, system programs, monitor services, file organization, and real-time applications.

*Prerequisite:* CS 230. *Not open to* students who have credit in CS 430.

**535 Programming Languages.** (3) Study of principles of programming languages. Emphasizes language paradigms and important features, structures, characteristics, and formal syntax of modern high-level programming languages. Examples of languages in each paradigm will be studied. Hours do not apply to master's degree in computer science.

Prerequisite: CS 230 or equivalent.

**536 Database Design.** (3) An introduction to database design, including physical representation,

modeling, database systems, and implementation.

Prerequisite: CS 324.

Not open to students who have credit in CS 436.

**538 Computer Graphics. (3)** Methods of developing, modifying, and rendering graphics displays. Emphasizes the design and writing of graphics software for both two- and three-dimensional displays. Knowledge of a structured high-level language is required.

Prerequisite: CS 324.

Not open to students who have credit in CS 438.

**539 Current Topics.** (3) In-depth study of a topic taught in a seminar format. Topics will be posted in the department before registration.

Prerequisite: CS 324, 335.

A total of 9 hours of credit may be earned, but no more than 6 in any one semester or term.

**545 Human-Computer Interaction.** (3) Investigation into the principles and practice of user interface design, evaluation, and implementation. Topics include user-centered design, graphical user interface programming, evaluation methods, and software architectures.

Prerequisite: CS 324.

**547 Computer, Information, and Network Security. (3)** Topics include encryption, decryption, protocols, viruses, network security, authentication, legal and ethical issues, and security in operating systems, databases, e-commerce, Internet, wireless. Algorithms, protocols, applications such as RSA, DES, SSL, Firewalls, Digital Signatures, and VPNs, and emerging topics will be explored. *Prerequisite:* CS 121.

**555 Data Mining.** (3) Topics include data preprocessing, clustering analysis, data classification, mining association rules, data mining and database, complex data mining, Web mining, new application in data mining such as intrusion detection and bio-informatics.

*Prerequisite:* CS 324. *Not open to* students who have credit in CS 455.

**556 Image Processing. (3)** Project based, dealing with basic principles of digital image processing and computer vision. Topics: digital image formats, geometric operations on digital images, filtering, histogramming, binarization of grayscale images, labeling binary images, perimeter and area determination, thinning operations, object recognition using global features, edge detection processes, and other topics as time permits.

Prerequisite: CS 324.

**557 Applied Cryptography.** (3) Introduction of basic principles and application of cryptography. Topics include encryption, decryption, private and public key systems, and their mathematical foundation: divisibility and Euclidean algorithms, arithmetic of congruences, and large prime numbers. Projects are implementations of related algorithms. LISP and JAVA are recommended languages.

Prerequisite: CS 324.

**570 Theory of Computation 1. (3)** Mathematical logic; alphabets and languages; finite automata, regular and nonregular languages, and Kleene's theorem; regular grammars; pushdown automata and context-free grammars; Turing and Post machines; recursive and recursively enumerable languages; the Chomsky Hierarchy.

*Prerequisite:* CS 324 or permission of the instructor. *Not open to* students who have credit in CS 470.

**576 Operating Systems. (3)** Investigate the functions and structure of computer operating systems, processors, and memory. Topics include process control, concurrency, scheduling, security, and file systems. Introduces topics in systems programming, including I/O programming, signals, and IPC.

Prerequisite: CS 230, 324.

Not open to students who have credit in CS 376.

**597 Multitier Web Architectures. (3)** Topics include n-tier architectures, data access and application logic layers, Web services, scalability, advanced XML, service-oriented architectures, object access protocols, and Web site administration and security. Projects will be used to reinforce concepts.

Prerequisite: CS 324.

Not open to students who have credit in CS 397.

**614 (514) Web Programming. (3)** Technical foundations for rich, interactive Web sites and current topics in Web programming. Client and server side Web programming to enable Web 2.0 applications. *Open only to* non computer science graduate students.

**616 (516) Digital Animation. (3)** Introduces tools and skills needed to create digital animations. Students work with different development environments, techniques, interface designs, and audio/visual sequences. *Open only to* non computer science graduate students.

**629 Special Topics.** (1-6) Special topics in computer science for non-CS graduate students. Topics will be posted by the department prior to registration.

A total of 6 hours of credit may be earned, but no more than 3 in any one semester or term.

**636** Advanced Database Systems. (3) Topics include knowledge representation and ontology concepts, object database concepts, database security and authorization, distributed databases, client-server architectures, Internet databases, and emerging database technologies and applications. Programming of both database techniques and application servers is based on current technologies such as ORACLE. *Prerequisite:* CS 536.

**638 Advanced Topics in Computer Graphics. (3)** Topics will be chosen from current research areas in computer graphics and from advanced topics in classical computer graphics. Possible topics include fractals, ray tracing, animation techniques, and geometric modeling.

Prerequisite: CS 538.

**639 Seminar in Computer Science. (3)** Readings and conferences assigned in some particular problem or group of problems in computer science.

Prerequisite: CS 324, 335.

**642 Simulation Techniques. (3)** An introduction to the principles and applications of simulation. Use of higher-level languages and simulation languages as applied to system studies. Use of examples from different subjects to carry out simulation.

Prerequisite: CS 121; MATHS 221.

**665** Applied Computational Geometry. (3) Topics such as algorithms for polygon triangulation, polygon partitioning and their applications, convex hulls in two and three dimensions and their applications, Voronoi diagrams and their applications, search and intersection algorithms, robot motion planning, and implementation of algorithms.

Prerequisite: CS 324 or permission of the instructor.

**668 Graphs, Algorithms, and Applications. (3)** Concepts of graph theory. Algorithms for graph traversal, shortest paths, connectivity, spanning trees, and matchings. Applications of graphs to computer programming, software engineering, VLSI design, networks and flows, and parallel programming.

Prerequisite: CS 324 or permission of the instructor.

**670 Theory of Computation 2. (3)** Computability and decidability; introduction to the theory of computational complexity; the classes sP and NP; NP-completeness; examples of some NP-complete problems; nondeterminism and parallel computation; proving the correctness of programs.

Prerequisite: CS 570.

**675 Model Checking.** (3) Overview of formal verification techniques in software engineering; system modeling with automata; temporal logics; algorithms and techniques of model checking; study and use of model checkers such as SPIN; applications of model checking to critical systems in industry. *Prerequisite:* CS 324, 335.

**678 Compiler Construction. (3)** Review of context-free grammars and basic parsing concept, compiler organization, and construction of components for a compiler.

Prerequisite: CS 570.

**689 Research Methods. (3)** Discussions on research areas in computer science, scientific methods of research, and dissemination of research. Requirements include presentations and written reports that demonstrate proficiency in presentation tools and techniques, statistical and experimental design techniques, and library and literature searches.

Prerequisite: 6 hours of CS graduate courses.

**690 (697) Software Engineering. (3)** Software engineering principles and concepts. The software life cycle, structured specifications, design tools and

techniques, software reliability, and verifying program correctness.

*Prerequisite:* CS 324 and 3 computer science graduate courses or permission of the instructor. *Not open to* students who have credit in CS 495.

**691 Software Requirements and Design. (3)** Methods, tools, and notations for requirements capture, analysis and design. Unified Modeling Language (UML), logic and algebraic specification, prototyping, use cases, domain modeling, software architecture, design patterns, refactoring, software reuse.

Prerequisite: CS 690.

**692 Software Verification and Validation.** (3) Concepts and techniques for testing software; unit, integration, system, and regression testing; test coverage, test case generation, tools for automated testing. Verification of nonfunctional properties.

Prerequisite: CS 690.

**699 Reading and Honors. (3)** Special advanced work not offered in other courses. Requirements include a final written report and a presentation in the departmental colloquium series.

Prerequisite: CS 324, 335; permission of the department chairperson.

A total of 6 hours of credit may be earned, but no more than 3 in any one semester or term.

A total of 12 hours of combined CS 539, 639, and 699 credit may be earned.

# **CRIMINAL JUSTICE AND CRIMINOLOGY**

<u>www.bsu.edu/cjc</u> North Quadrangle 278, 765-285-5979

# CRIMINAL JUSTICE AND CRIMINOLOGY (CJC)
**650** Criminal Justice Administration. (3) An examination of the study of the principles of administration of criminal justice agencies and the development of present and future criminal justice leaders.

**651 Interpersonal Relations in Criminal Justice.** (3) Exploration of interpersonal relationships in an agency context. Examines issues peculiar to criminal justice agencies, including cynicism, trauma, burnout, everyday stressors, authoritarian management structures and leadership styles, peer loyalty versus organizational loyalty versus public duty, and public relations.

**652** Philosophical Aspects of Criminal Justice Practice. (3) Provides philosophical and moral bases for the establishment and operation of justice system agencies charged with enforcement of criminal codes and preservation of social order, including an overview of fundamental philosophical issues of justice-system practices.

**690 Independent Study in Criminal Justice.** (1-3) An opportunity to study specific topics related to the criminal justice system.

*Prerequisite:* permission of the instructor. A total of 3 hours of credit may be earned.

## ENGLISH

<u>www.bsu.edu/english</u> Robert Bell Building 297, 765-285-8580

## PROGRAMS

Master of arts (MA) in English (general, rhetoric and composition, creative writing, and literature), in linguistics, and in teaching English to speakers of other languages (TESOL); doctor of philosophy (PhD) in English (with concentration areas in literature, in rhetoric and composition, and in applied linguistics).

Cognates are available in composition, literary theory, literature, linguistics, TESOL, and English language arts.

## MASTER OF ARTS IN ENGLISH (CREATIVE WRITING)

## **Admission requirements**

Applicants must meet the admission requirements of the Graduate School, have an undergraduate gradepoint average (GPA) of at least 3.0, and submit Graduate Record Examination (GRE) scores (required for native speakers of English) or Test of English as a Foreign Language (TOEFL) scores (required for nonnative speakers of English), a statement of purpose (750-1000 words), portfolio of 20 pages of creative writing, and three letters of recommendation.

## **Degree requirements**

PREFIX NO SHORT TITLE CR HRS

Core requirements ENG 610 Rdg Wrtg Grs 3

605 Tch Eng Stu (3) or 614 Pr Lit Edit (3) 3 Complete 3-9 hours from ENG 611 Wkp Cr Nonfi (3-9) and/or 612 Fict Wtg Wkp (3-9) and/or 613 Poetry Wr Wk (3-9) and/or 615 Screnwrt Wkp (3-9) 3-9 Courses in literature 6 CRPRJ 698 Creat Proj (3 or 6) 6 Electives 6 33 hrs

## MASTER OF ARTS IN ENGLISH (GENERAL)

## **Admission requirements**

Applicants must meet the admission requirements of the Graduate School, have an undergraduate gradepoint average (GPA) of at least 3.0, and submit Graduate Record Examination (GRE) scores (required for native speakers of English) or Test of English as a Foreign Language (TOEFL) scores (required for nonnative speakers of English), a statement of purpose (750-1000 words), examples of their scholarly or critical writing, and three letters of recommendation.

## **Degree requirements**

PREFIX NO SHORT TITLE CR HRS Core requirements Approved courses in English 15-29 Research requirements ENG 601 Res Eng Stu (3) or RES 697 Research Ppr (1-3) or THES 698 Thesis (1-6) 3-6 0-14 Minors and electives

32 hrs

## MASTER OF ARTS IN ENGLISH (LITERATURE)

## **Admission requirements**

Applicants must meet the admission requirements of the Graduate School, have an undergraduate gradepoint average (GPA) of at least 3.0, and submit Graduate Record Examination (GRE) scores (required for native speakers of English) or Test of English as a Foreign Language (TOEFL) scores (required for nonnative speakers of English), submit scores on the GRE specialized test "Literature in English," a statement of purpose (750-1000 words), examples of their scholarly or critical writing, and three letters of recommendation.

## **Degree requirements**

PREFIX NO SHORT TITLE CR HRS Core requirements ENG 601 Res Eng Stu 3 606 Lit Theory 1 (3) or 607 Lit Theory 2 (3) 3 17-20 hours of approved graduate courses in literature including American literature 6 British and World literature Before 1660 3 After 1660 3 5-8 Approved literature electives Research requirement RES 697 Research Ppr (1-3) or THES 698 Thesis (1-6) 3-6 Electives 0-3 32 hrs

## MASTER OF ARTS IN ENGLISH (RHETORIC AND COMPOSITION)

## **Admission requirements**

Applicants must meet the admission requirements of the Graduate School, have an undergraduate gradepoint average (GPA) of at least 3.0, submit Graduate Record Examination (GRE) scores (required for native speakers of English) or Test of English as a Foreign Language (TOEFL) scores (required for nonnative speakers of English), a statement of purpose (750 to 1000 words), examples of their scholarly or critical writing, and three letters of recommendation.

## **Degree requirements**

PREFIX NO SHORT TITLE CR HRS

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1 Ore	requirements
COIC	requirements
	1

Core requ		1100	
ENG	601	Res Eng Stu	3
	604	Tch Tech	3
	620	Ling St Eng	3
	690	Seminar Comp	3
	609	In Writ Proj (3)	
	or		
	693	Writ in Prof (3)	3
	694	Cls Rhetoric	3
	699	Contemp Comp	3
Research	requir	rements	
RES	697	Research Ppr (1-3)	
	or	<b></b>	
THES	698	Thesis (1-6)	3-6
Electives			5-11
			32 hrs

ENG 601 may be waived for students who choose the nonthesis option.

## **MASTER OF ARTS IN LINGUISTICS**

## **Admission requirements**

Applicants must meet the admission requirements of the Graduate School, have an undergraduate gradepoint average (GPA) of at least 3.0, have the equivalent of at least two years of college-level study of foreign language (requirement can be met during MA program), and submit a statement of purpose (750 to 1000 words), Graduate Record Examination (GRE) scores (required for native speakers of English) or Test of English as a Foreign Language (TOEFL) scores (required for nonnative speakers of English), examples of their scholarly writing, and three letters of recommendation.

## **Degree requirements**

PREFIX NO SHORT TITLE CR HRS

ENG 520 or the equivalent will be required but will not count towards required hours in the degree.

## Major requirements

ENG	621	Mean Str Eng	3
	623	Phon & Phonl	3
	626	Morph & Synt	3
	627	Socioling	3

Directed electives (at least 15 hours from the following courses): ENG

622 His Eng Lang (3)

- 625 Phonology (3)
- 628 Lang Culture (3)
- 629 Top Ap Ling (3)

630	Contras Anls (3)	
631	Hist Linguis (3)	
632	Discrs Anls (3)	
682	Top Eng Ling (3)	
686	Top in Ling (3)	15

Electives

(3 hours, an additional course from the directed electives or any of the following):

ENG	624	Found S L A (3)	
	684	Topics S L A (3)	
	693	Writ in Prof (3)	3

Research requirement

ENG	601	Res Eng Stu	3
	and		
RES	697	Research Ppr (1-3)	
	or		
CRPRJ	698	Creat Proj (3 or 6)	3

36 hrs

Depending on the nature of the student's research, the student may also be advised to take one or more courses in Experimental Design and Statistics in addition to other course work.

# MASTER OF ARTS IN TEACHING ENGLISH TO SPEAKERS OF OTHER LANGUAGES (TESOL)

## **Admission requirments**

Applicants must meet the admission requirements of the Graduate School, have an undergraduate gradepoint average (GPA) of at least 3.0, have the equivalent of at least two years of college-level study of foreign language (requirement can be met during MA program), and submit a statement of purpose (750 to 1000 words), Graduate Record Examination (GRE) scores (required for native speakers of English) or Test of English as a Foreign Language (TOEFL) scores (required for nonnative speakers of English), examples of their scholarly writing, and three letters of recommendation.

## **Degree requirements**

PREFIX NO SHORT TITLE CR HRS

ENG 520 or the equivalent will be required but will not count towards required hours in the degree.

Major requirements

ENG	616	Th Lan Learn	3
	617	Meth Tch ELL	3
	618	Mat Tch ELL	3
	624	Found S L A	3

Directed electives

18 hours from

ENG	605	Tch Eng Stu (3)	
	621	Mean Str Eng (3)	
	622	His Eng Lang (3)	
	623	Phon & Phonl (3)	
	625	Phonology (3)	
	626	Morph & Synt (3)	
	627	Socioling (3)	
	628	Lang Culture (3)	
	629	Top Ap Ling (3)	
	630	Contras Anls (3)	
	631	Hist Linguis (3)	
	632	Discrs Anls (3)	
	682	Top Eng Ling (3)	
	684	Topics S L A (3)	
	686	Top in Ling (3)	
	693	Writ in Prof (3)	18
Researc	h requi	rements	
ENG	601	Res Eng Stu	3
	and		-

and RES 697 Research Ppr (1-3) or CRPRJ 698 Creat Proj (3 or 6) 3

36 hrs

Depending on the nature of the student's research, the student may also be advised to take one or more courses in Experimental Design and Statistics in addition to other course work.

# MASTER OF ARTS IN TEACHING ENGLISH TO SPEAKERS OF OTHER LANGUAGES (TESOL) AND LINGUISTICS

## **Admission requirements**

Applicants must meet the admission requirements of the Graduate School, have an undergraduate gradepoint average (GPA) of at least 3.0, have the equivalent of at least two years of college-level study of foreign language (requirement can be met during MA program), and submit a statement of purpose (750 to 1000 words), Graduate Record Examination (GRE) scores (required for native speakers of English) or Test of English as a Foreign Language (TOEFL) scores (required for nonnative speakers of English), examples of their scholarly writing, and three letters of recommendation.

## **Degree requirements**

PREFIX NO SHORT TITLE CR HRS

ENG 520 or the equivalent will be required but will not count towards required hours in the degree.

Major requirements

ENG	616	Th Lan Learn	3
	617	Meth Tch ELL	3
	618	Mat Tch ELL	3
	621	Mean Str Eng	3
	623	Phon & Phonl	3
	624	Found S L A	3
	626	Morph & Synt	3
	627	Socioling	3

Directed electives (at least 15 hours from the following courses):

ENG	605	Tch Eng Stu (3)	
	622	His Eng Lang (3)	
	625	Phonology (3)	
	628	Lang Culture (3)	
	629	Top Ap Ling (3)	
	630	Contras Anls (3)	
	631	Hist Linguis (3)	
	632	Discrs Anls (3)	
	682	Top Eng Ling (3)	
	684	Topics S L A (3)	
	686	Top in Ling (3)	
	693	Writ in Prof (3)	15

**Research** requirements

ENG	601	Res Eng Stu	3
	and		
RES	697	Research Ppr (1-3)	
	or		
CRPRJ	698	Creat Proj (3 or 6)	3
		-	

45 hrs

Depending on the nature of the student's research, the student may also be advised to take one or more courses in Experimental Design and Statistics in addition to other course work.

## DOCTOR OF PHILOSOPHY (PhD) IN ENGLISH

## **Concentration in Applied Linguistics**

## **Admission requirements**

Applicants to the PhD in English with a concentration in applied linguistics must hold an earned master's or equivalent degree and meet the admission requirements of the Graduate School, submit a statement of purpose (750 to 1000 words), graduate grade-point average (GPA) of at least 3.3 (preferably 3.5), cumulative GRE general scores (required for native speakers of English) or (for nonnative speakers of English) cumulative TOEFL scores of at least 575 (or equivalent), and submit examples of their scholarly or critical writing and three letters of recommendation. Before writing comprehensive examinations, candidates must demonstrate competence in two foreign languages, other than English, relevant to their research.

## **Degree requirements**

The PhD in English with a concentration in applied linguistics requires a total of 48 graduate hours and a dissertation (with 10 associated hours to be taken at Ball State). Up to 32 hours from the masters degree may be applied to the total of 90 hours for the doctoral degree. Students may elect to take one or more cognates in an appropriate department or university area. ENG 520 Introduction to Linguistics and a graduate research course are prerequisites to the program. Students who have not taken them or done equivalent work must take ENG 520 or an additional 3 hours of ENG 601, but these courses will not be included in the 48 hours of course work required for graduation. Transfer credit (up to) 32

Required core courses

Students must complete the following four courses as early as possible in the program.

PREFIX NOSHORT TITLECR HRSENG621Mean Str Eng3623Phon & Phonl3626Morph & Synt3627Socioling3

At the end of the first year of doctoral study, doctoral students will undergo a review to determine their fitness to continue in the program. This review will examine their academic and professional performance to this point in the doctoral program. Details regarding this review will be outlined during the fall semester each year, and the due date for review materials will be set. Students will have at least one month to prepare the materials to be turned in at some point during the spring semester. Students who are not advanced will be permitted to complete a master's degree but will not be permitted to continue in the doctoral program.

## Directed electives

Students must choose at least 18 hours from the following courses. Students may be advised to take one or more courses in Experimental Design and Statistics in addition to other course work.

ENG	622	His Eng Lang (3)	
	624	Found S L A (3)	
	625	Phonology (3)	
	628	Lang Culture (3)	
	629	Top Ap Ling (3)	
	630	Contras Anls (3)	
	631	Hist Linguis (3)	
	632	Discrs Anls (3)	
	682	Top Eng Ling (3)	
	684	Topics S L A (3)	
	686	Top in Ling (3)	
	693	Writ in Prof (3)	
	701	Ind Study (3)	
	729	Adv Top Ling (3)	18

Electives

15

## Research requirement

DISS	799	Drs Dissert (1-24)	10
ENG	601	Res Eng Stu	3

#### 90 hrs

## **Concentration in Literature**

## **Admission requirements**

Applicants for the PhD in English with a concentration in literature must hold an earned master's or equivalent degree, meet the admission requirements of the Graduate School, and submit a statement of purpose (750 to 1000 words), Graduate Record Examination (GRE) scores of at least 550 on verbal aptitude (preferred), a graduate GPA of at least 3.3 (preferably 3.5), examples of their scholarly or critical writing, and three letters of recommendation. Nonnative speakers of English may substitute TOEFL scores for the GRE aptitude test. In addition, all applicants for the concentration in literature must submit scores for the GRE subject test in literature of at least 550 (preferred).

PREFIX NO SHORT TITLE CR HRS ENG 601 Res Eng Stu 3 Tch Eng Stu (3) 6 605 606 Lit Theory 1 (3) or 607 Lit Theory 2 (3) 3 693 Writ in Prof 3 3 hours in each of the following areas: (must include at least 3 hours of American Literature) British Literature to 1500: British/American literature 1500-1700; British/American literature 1700-1800; British/American literature 1800-1900; Literature 1900-present. 15 One course in one of the following areas: American ethnic studies Gender studies International studies 3 Directed electives At least 15 hours of electives in courses chosen in consultation with advisor. 15 Electives 24 799 Drs Dissert (1-24) DISS 18 90 hrs

ENG 605 is to be taken once as "Composition" and a second time as "Literature."

## **Concentration in Rhetoric and Composition**

## **Admission requirements**

Applicants for the PhD in English with a concentration in rhetoric and composition must hold an earned master's or equivalent degree, meet the admission requirements of the Graduate School, and submit a statement of purpose (750 to 1000 words), GRE score of at least 550 (preferred) on verbal aptitude, a graduate GPA of at least 3.3 (preferably 3.5), examples of their scholarly or critical writing, and three letters of recommendation. Nonnative speakers of English may substitute TOEFL scores for the GRE scores.

## **Degree requirements**

PREFIX	NO	SHORT TITLE	CR HRS
ENG	605	Tch Eng Stu	3
	606	Lit Theory 1	3
	620	Ling St Eng	3
	693	Writ in Prof	3
	699	Contemp Comp	3
3 (rhetori each of th Rhetorica Digital L Research	c and ne folle al Hist iteraci Meth	composition) hours owing areas: ory es odologies	; in
Research	Wieun	ouologies	7
9 additio	nal ho	urs directed elective	es
in one of	the th	ree areas of emphas	sis 9
Electives			9
Course w	ork fr	om Master's degree	e
or equiva	lent	C	32
DISŜ	799	Drs Dissert (1-24)	16
			90 hrs

## DOCTORAL COGNATE IN LITERARY THEORY

See the department for information regarding course selection.

For purposes of advising, enrollment in all graduate courses in the Department of English requires permission of the department.

## **ENGLISH (ENG)**

**520 Introduction to Linguistics. (3)** Basic concepts, scope, and methodology of the science of language. *Prerequisite:* permission of the department chairperson. *Not open to* students who have credit in ENG 320.

**588 English Studies Abroad. (3-6)** English studies at approved study abroad sites. Credit applied to department requirements as approved by the department chairperson.

*Prerequisite:* permission of the department chairperson. A total of 6 hours of credit may be earned.

**601 Research in English Studies. (3)** Research methods in composition, English education, language and linguistics, and/or literature.

Prerequisite: permission of the department chairperson.

A total of 6 hours of credit may be earned, but no more than 3 in any one semester or term.

**602 English Internship. (1-6)** Supervised work experience appropriate for English graduate students. Assignments may be part-time or full-time, paid or unpaid, for one or more semesters in approved businesses or organizations.

Prerequisite: permission of the internship coordinator or department chairperson.

A total of 6 hours of credit may be earned. A maximum of 3 hours may apply as elective credit toward the MA or PhD in English.

**603 Independent Study. (1-3)** Independent study and research in composition, creative writing, English education, language and linguistics, or literature.

Prerequisite: permission of the department chairperson.

A total of 9 hours of credit may be earned, but no more than 3 in any one semester or term.

**604 Teaching with Technology.** (3) Theory and practice of using major technologies in the teaching of English; primary emphasis on postsecondary level. Focuses on practical activities related to planning and carrying out text-intensive teaching with technology.

Prerequisite: permission of the department chairperson.

**605 Teaching in English Studies. (3)** Instruction and, where appropriate, close supervision in pedagogical theory and practice and other proficiencies and skills required for success in university teaching.

Prerequisite: permission of the department chairperson.

A total of 9 hours of credit may be earned, but no more than 3 in any one semester or term.

**606 Literary Theory 1. (3)** Critical theory through New Criticism and its application to selections from the various forms of literature.

Prerequisite: permission of the department chairperson.

**607 Literary Theory 2. (3)** Contemporary critical theory and its application to selections from the various forms of literature.

Prerequisite: permission of the department chairperson.

A total of 6 hours of credit may be earned, but no more than 3 in any one semester or term.

**608 Seminar in Theory. (3)** Topics in theory. Advanced study of the work of specified theorists or in specified theoretical paradigms.

Prerequisite: permission of the department chairperson.

A total of 9 hours of credit may be earned, but no more than 3 in any one semester or term.

**609 Indiana Writing Project. (1-6)** Training in writing, research, and teaching according to the National Writing Project model. Taught by the Indiana Writing Project (IWP) director or codirector assisted by teacher consultants. Applies to a degree only with the department chairperson's permission. The course is not intended to substitute for certification or degree requirements.

Prerequisite: permission after application to the IWP director.

A total of 9 hours of credit may be earned, but no more than 6 in any one semester or term.

**610 Reading and Writing Across the Genres. (3)** A comprehensive introduction to graduate creative writing, with study and practice of the forms and techniques of fiction, poetry, and creative nonfiction. *Prerequisite:* permission of the department chairperson.

**611 Workshop in Creative Non-Fiction. (3)** Instruction, practice, and criticism in a workshop format. *Prerequisite:* permission of the department chairperson. A total of 9 hours of credit may be earned, but no more than 3 in any one semester or term.

612 Workshop in Fiction Writing. (3) Instruction, practice, and criticism in a workshop format. *Prerequisite:* permission of the department chairperson. A total of 9 hours of credit may be earned, but no more than 3 in any one semester or term.

**613 Workshop in Poetry Writing. (3)** Instruction, practice, and criticism in a workshop format. *Prerequisite:* permission of the department chairperson. A total of 9 hours of credit may be earned, but no more than 3 in any one semester or term.

**614 Practicum in Literary Editing. (3)** History and philosophy of literary publishing, with practical experience in editorial work and production in print and electronic formats. *Prerequisite:* permission of the department chairperson.

**615 Workshop in Screenwriting. (3)** Instruction, practice, and criticism in screenwriting in a workshop format.

*Prerequisite:* permission of the department chairperson. A total of 9 hours of credit may be earned, but no more than 3 in any one semester or term.

**616 Introduction to Theories of Language Learning. (3)** Psychological, sociocultural, and linguistic basis of language learning; research and theoretical perspectives related to second language teaching. *Prerequisite:* knowledge of a foreign language; permission of the department chairperson. *Prerequisite or parallel:* ENG 520 or equivalent.

**617 Methods for Teaching English Language Learners. (3)** Study and practice of a variety of methods in teaching English language learners in second or foreign language settings.

*Prerequisite:* permission of the department chairperson. *Prerequisite or parallel:* ENG 520 or equivalent.

**618 Materials Development for Teaching English Language Learners. (3)** Focus on the use and design of materials to meet the specific needs of language learners at various levels of proficiency in second and foreign language settings.

*Prerequisite:* permission of the department chairperson. *Prerequisite or parallel:* ENG 520 or equivalent.

**620 Linguistics and the Study of English. (3)** An introduction for nonspecialists to areas of linguistics pertinent to the study and teaching of English literature and composition.

Prerequisite: permission of the department chairperson.

**621 Meaning and Structure in English. (3)** An integrated study of the syntax, semantics, and pragmatics of the English language. Introduces key concepts in syntactic, semantic, and pragmatic analysis, and focuses on aspects of English lexical and grammatical structure most problematic in the teaching of English as a second/foreign language.

Prerequisite: ENG 520; permission of the department chairperson.

622 History of the English Language. (3) History of the development of the phonological, morphological, lexical, and syntactical systems of the English language from its beginnings to the present day.

Prerequisite: permission of the department chairperson.

623 Phonetics and Phonology. (3) Speech sounds and the linguistic methods employed in their description, classification, and analysis as elements in language systems. Relationships among speech sounds in a language.

Prerequisite: permission of the department chairperson.

624 Foundations of Second Language Acquisition. (3) Covers the foundations of second language acquisition theories and research, and introduces various issues related to second language learning and teaching.

Prerequisite: ENG 616, 617; permission of the department chairperson.

625 Phonology. (3) General characteristics of speech sounds and of the systematic relationships they exhibit in natural languages. Emphasizes current research in generative phonology. Prerequisite: ENG 623; permission of the department chairperson.

626 Morphology and Syntax. (3) A detailed examination of the patterns of word and phrase building in natural languages. Emphasizes both formal and functional approaches.

Prerequisite: ENG 520; permission of the department chairperson.

627 Sociolinguistics. (3) Examines the correlation of linguistic variation with geographic areas and social variables such as sex, age, socioeconomic status, and ethnicity.

Prerequisite: ENG 320 or 520; permission of the department chairperson.

628 Language and Culture. (3) Examines the ways members of different cultures organize and exploit their linguistic resources. Topics include registers and forms of address, verbal art, conversational strategies, code-switching, language maintenance and death, and cross-cultural miscommunication. Prerequisite: permission of the department chairperson.

**629** Topics in Applied Linguistics. (3) Intensive study of a selected topic or closely related set of topics relevant to applied linguistics. May be repeated if the topic changes.

Prerequisite: ENG 520 or equivalent; 9 additional hours in applied linguistics or permission of the department chairperson.

A total of 9 hours of credit may be earned, but no more than 3 in any one semester or term.

630 Contrastive Analysis. (3) Study of language universals and comparison of the structural systems of natural languages.

Prerequisite: ENG 520, 621; knowledge of a foreign language; permission of the department chairperson.

631 Historical Linguistics. (3) Scientific study of the process of linguistic change. A survey of the methods and principles used in historical and comparative linguistic analysis.

Prerequisite: ENG 623, 625; permission of the department chairperson.

632 Discourse Analysis. (3) A detailed examination of the principal methods of analyzing oral and written discourse.

Prerequisite: ENG 520 or 621; permission of the department chairperson.

**633 Practicum in Teaching English to Speakers of Other Languages.** (1-6) Practical experience related to the teaching of English as a second or foreign language.

*Prerequisite:* permission of the department chairperson. *Parallel:* ENG 616 or 617. A total of 6 hours of credit may be earned.

**640 Studies in American Authors. (3)** Focused study of the works and lives of selected American authors.

Prerequisite: permission of the department chairperson.

A total of 6 hours of credit may be earned, but no more than 3 in any one semester or term.

**641 Early American Literature. (3)** Examination of selected literary works written through 1830. Attention will also be given to cultural, political, and intellectual contexts and to current scholarship on the period.

Prerequisite: permission of the department chairperson.

A total of 6 hours of credit may be earned, but no more than 3 in any one semester or term.

**642 Literature of the American Renaissance. (3)** Examination of literary works written from 1830 to 1865. Attention will also be given to cultural, political, and intellectual contexts, and to current scholarship on the period.

Prerequisite: permission of the department chairperson.

A total of 6 hours of credit may be earned, but no more than 3 in any one semester or term.

**643** American Realism and Naturalism. (3) Examination of selected literary works from the middle of the nineteenth century into the earliest part of the twentieth century. Considers authors, their work, their philosophies of art, and current scholarship on the period.

Prerequisite: permission of the department chairperson.

A total of 6 hours of credit may be earned, but no more than 3 in any one semester or term.

**644 Early Twentieth-Century American Literature.** (3) Examination of literary works and intellectual and aesthetic movements during the first half of the twentieth century. Attention will be given to cultural, political, and intellectual contexts and to current scholarship on the period.

Prerequisite: permission of the department chairperson.

A total of 6 hours of credit may be earned, but no more than 3 in any one semester or term.

# **645 Contemporary American Literature. (3)** Examination of literary works from 1945 to the present. *Prerequisite:* permission of the department chairperson.

A total of 6 hours of credit may be earned, but no more than 3 in any one semester or term.

**646 Studies in American Ethnic Literature. (3)** Study of literary works that express the experiences and cultures of American population groups whose voices have not been adequately represented in the literary and social mainstream.

Prerequisite: permission of the department chairperson.

A total of 6 hours of credit may be earned, but no more than 3 in any one semester or term.

**647** African American Literature. (3) Examines African American literature focusing on the role of vernacular speech and music; the social status of African Americans and their relations with other racial groups; the connections between race, class, gender, and sexuality; and relevant literary criticism and theory.

Prerequisite: permission of the department chairperson.

A total of 6 hours of credit may be earned, but no more than 3 in any one semester or term.

**650 Seminar in Literature. (3)** Special topics in literature. Advanced study of a time period, form, nation, and/or specific issue or problem in literary studies.

Prerequisite: permission of the department chairperson.

A total of 6 hours of credit may be earned, but no more than 3 in any one semester or term.

**651 Studies in the Novel. (3)** Special topics in the novel. Advanced study of a time period, form, nation and/or specific issue or problem.

Prerequisite: permission of the department chairperson.

A total of 6 hours of credit may be earned, but no more than 3 in any one semester or term.

**652 Studies in Poetry. (3)** Special topics in poetry. Advanced study of a time period, form, nation and/or specific issue or problem.

Prerequisite: permission of the department chairperson.

A total of 6 hours of credit may be earned, but no more than 3 in any one semester or term.

**653 Studies in Drama.** (3) Special topics in drama. Advanced study of a time period, form, nation and/or specific issue or problem.

Prerequisite: permission of the department chairperson.

A total of 6 hours of credit may be earned, but no more than 3 in any one semester or term.

**654 Film Studies. (3)** Investigation of theoretical and critical approaches to the cinematic text, which may include studies of language, form, history, reception, narrative, culture, ideological formation, technological innovation, and representation.

Prerequisite: permission of the department chairperson.

A total of 6 hours of credit may be earned, but no more than 3 in any one semester or term.

**655 Gender Studies. (3)** Exploration of issues in gender theory, which may include studies of power, language, literature, culture, identity, sexuality, representation, and pedagogy, as well as interdisciplinary connections to other political and philosophical theories of race, class, gender, ethnicity, and nationality.

Prerequisite: permission of the department chairperson.

A total of 6 hours of credit may be earned, but no more than 3 in any one semester or term.

**656 Cultural Studies. (3)** Investigation of cultural studies as it relates to specific texts, social themes, and issues.

*Prerequisite:* permission of the department chairperson. A total of 6 hours of credit may be earned, but no more than 3 in any one semester or term.

**657 Post-Colonial Studies. (3)** Focused study of post-colonial literature and literary theory. *Prerequisite:* permission of the department chairperson.

A total of 6 hours of credit may be earned, but no more than 3 in any one semester or term.

**659 Workshop in Literature. (3-9)** Specific themes or specific units of American, British, or world literature. Stresses both the cooperative efforts of participants and faculty and the critical approaches to literature that are most useful in reading and teaching the literature.

Prerequisite: permission of the department chairperson.

A total of 9 hours of credit may be earned.

**660 Studies in British Authors. (3)** Focused study of the works and lives of selected British authors. *Prerequisite:* permission of the department chairperson.

A total of 6 hours of credit may be earned, but no more than 3 in any one semester or term.

**661 Early British Studies. (3)** Intensive study of early British literature emphasizing language, sources, structure, and significance of the works. Aspects of early culture pertinent to the works will be considered.

Prerequisite: permission of the department chairperson.

A total of 6 hours of credit may be earned, but no more than 3 in any one semester or term.

**662 Renaissance and Seventeenth-Century Studies. (3-6)** Study of selected works of English literature of the Tudor, Stuart, and Puritan periods (1485-1660).

Prerequisite: permission of the department chairperson.

A total of 6 hours of credit may be earned.

**663 Studies in Shakespeare. (3)** Study of major Shakespearean dramas and major Shakespearean criticism. Some attention given to the sonnets.

Prerequisite: permission of the department chairperson.

A total of 6 hours of credit may be earned, but no more than 3 in any one semester or term.

**664 Studies in English Literature of the Restoration and Eighteenth Century.** (3) An extensive study of the nondramatic works of Dryden, Swift, Pope, and Johnson, with possible supplementary readings from other British authors of the period 1660-1800.

Prerequisite: permission of the department chairperson.

A total of 6 hours of credit may be earned, but no more than 3 in any one semester or term.

**665 Romantic Studies. (3)** Examination of literary works from the Romantic period. Attention given to the cultural and intellectual contexts of the period as well as current scholarship relevant to the period.

Prerequisite: permission of the department chairperson.

A total of 6 hours of credit may be earned, but no more than 3 in any one semester or term.

**667 Victorian Studies. (3)** Examination of literature of the Victorian period. Attention given to cultural and intellectual contexts and to the current scholarship relevant to the period.

*Prerequisite:* permission of the department chairperson.

A total of 6 hours of credit may be earned, but no more than 3 in any one semester or term.

**668 Early Twentieth-Century British Literature.** (3) Focused study of selected works in early-twentieth-century British literature and culture.

Prerequisite: permission of the department chairperson.

A total of 6 hours of credit may be earned, but no more than 3 in any one semester or term.

**669 Contemporary British Literature.** (3) Focused study of selected works in contemporary British literature and culture.

Prerequisite: permission of the department chairperson.

A total of 6 hours of credit may be earned, but no more than 3 in any one semester or term.

**670 Seminar in English Education. (3-9)** Investigations of special topics related to the teaching of English.

*Prerequisite:* permission of the department chairperson. A total of 9 hours of credit may be earned.

**671 Reading Texts in the English Classroom. (3)** Emphasizes current theoretical and research bases for effective reading of texts in the English classroom.

*Prerequisite:* permission of the department chairperson.

## 672 Workshop in English Language Arts.

(3-9) A study of the objectives, materials, and teaching techniques employed at the various levels of English language arts instruction with emphasis on application to specific classroom situations. Course content and requirements designed to meet individual needs and interest.

Prerequisite: permission of the department chairperson.

A total of 9 hours of credit may be earned.

673 English Language and Grammar in the Schools. (3) An introduction to the scientific study of the English language. The relation of contemporary language description and research to the teaching of English skills in the schools.

Prerequisite: permission of the department chairperson.

674 Teaching English Language Arts in the Elementary Grades. (3) A critical review of trends and issues and their implications for the teacher in the elementary grades.

Prerequisite: permission of the department chairperson.

675 Teaching Writing in Secondary Schools. (3) Advanced pedagogy, theory, research, and current issues in teaching writing, language, and visual representation, along with the use of performance assessments in the English Language Arts classroom.

Prerequisite: permission of the department chairperson.

676 Teaching Literature, Speaking and Listening in Secondary Schools. (3) Advanced pedagogy, theory, research, and current issues in teaching literature,

speaking, and listening in the English Language Arts classroom.

Prerequisite: permission of the department chairperson.

677 Literature for Young Children. (2) Appraisal of literature for young children. Of special interest to students of early-childhood education.

Prerequisite: permission of the department chairperson.

678 Children's Literature. (3) Overview of the field of children's literature and intensive study of the various genres. Includes study of theoretical issues, research, and recommended practice in teaching children's literature along with the study of a sampling of recently published children's books.

Prerequisite: permission of the department chairperson.

679 Young Adult Literature. (3) Recent literature suitable for students of varying abilities in junior high/middle and secondary schools. Emphasizes the actual reading of selections with some attention given to methodology.

Prerequisite: permission of the department chairperson. Not open to students who have credit in ENG 414.

680 History of English Education. (3) A comprehensive review of the history of English education and the development of English as a school subject in the core curriculum.

Prerequisite: permission of the department chairperson.

681 Reading in English Language Arts Education. (3) A critical review of significant research in English education and its implications for teaching English in the schools.

Prerequisite: permission of the department chairperson.

**682** Topics in English Linguistics. (3) Intensive study of a selected topic or closely related set of topics relevant to English linguistics.

Prerequisite: ENG 520 or equivalent; permission of the department chairperson.

A total of 9 hours of credit may be earned, but no more than 3 in any one semester or term.

684 Topics in Second Language Acquisition. (3) Intensive study of a selected topic or closely related set of topics relevant to Second Language Acquisition.

Prerequisite: ENG 520 or equivalent; ENG 616; permission of the department chairperson. A total of 9 hours of credit may be earned, but no more than 3 in any one semester or term.

**686 Topics in Linguistics.** (3) Intensive descriptive, theoretical, or applied study of a selected topic or closely related set of topics relevant to linguistics and any of the world's languages.

Prerequisite: ENG 520 or equivalent; permission of the department chairperson.

A total of 9 hours of credit may be earned, but no more than 3 in any one semester or term.

690 Seminar in Composition. (3) Special research problems in English composition using recognized techniques of research, extensive readings in selected texts, group discussions, and conferences.

Prerequisite: permission of the department chairperson.

A total of 9 hours of credit may be earned.

691 Advanced Composition. (3) Principles of and practice in the writing and evaluation of expository prose. Intended for teachers of English at the elementary, secondary, and college levels. Prerequisite: permission of the department chairperson.

692 Writing Technologies. (3) Examination of relationships among literacy, technology, and English studies. Includes a historical approach to literacy, with major attention to how past and present technologies of literacy affect culture and education. Will explore issues and practices in laboratory sessions.

*Prerequisite:* permission of the department chairperson.

693 Writing in the Profession. (3) Directed writing in some of the modes required in the academic profession of English studies, with a view toward producing effective, publishable prose.

Prerequisite: permission of the department chairperson.

694 Classical Rhetoric. (3) A survey of the history and development of classical rhetoric in English composition. Special research problems in the explication of standard literary texts from a classical rhetorical perspective. Extensive readings in selected texts, some in translations from Latin and Greek. Prerequisite: permission of the department chairperson.

695 Medieval and Early Modern Rhetoric. (3) A survey of Western rhetorical theory and practice from the fifth into the seventeenth century. Offers insight into the vocation and impact of rhetoric in the medieval and early modern period, with emphasis on implications for literacy and education.

Prerequisite: permission of the department chairperson.

696 Nineteenth-Century Rhetoric. (3) Survey of the nineteenth-century theories of composition that established the roots of contemporary teaching practices. Special research problems from a nineteenthcentury rhetorical perspective using recognized techniques of research, extensive readings in selected texts, group discussions, and conferences.

Prerequisite: permission of the department chairperson.

**697** Contemporary Rhetoric. (3) Overview of major contemporary rhetorical theories and practice, focusing on several major rhetoricians and recent developments in the field. Special research problems using recognized techniques of research, extensive reading in selected texts, group discussions, and conferences.

Prerequisite: permission of the department chairperson.

**698 Rhetoric and Poetics. (3)** Covers identification and theories of poetics in all genres. Includes classical schemes and tropes and contemporary theories about epistemology and figures of speech. Surveys Aristotle's poetics through contemporary criticism.

Prerequisite: permission of the department chairperson.

**699** Contemporary Theories of Composition. (3) Focuses on theories of writing prominent during the past hundred years, contextualizing those theories in terms of history, political movements, theoretical milieux, and educational changes. Connections made to similar shifts in perspective across the academic landscape.

Prerequisite: permission of the department chairperson.

**701 Independent Study.** (1- 3) Intensive study of a topic in literature, composition, or linguistics not ordinarily addressed in a regularly scheduled course. Intended to prepare doctoral students on a tutorial basis to research and develop an original dissertation topic.

Prerequisite: permission of the department chairperson.

A total of 9 hours of credit may be earned, but no more than 3 in any one semester or term.

**729 Advanced Topics in Linguistics. (3)** Intensive advanced study of a selected topic or closely related set of topics relevant to linguistics and applied linguistics.

Prerequisite: permission of the department chairperson.

A total of 9 hours of credit may be earned, but no more than 3 in any one semester or term.

## GEOGRAPHY

<u>www.bsu.edu/geog</u> Cooper Life Science Building 425, 765-285-1776

## MASTER OF SCIENCE (MS) IN GEOGRAPHY

This program is designed to provide a solid background in skills such as remote sensing, GIS, and advanced cartography to be applied to various sub-disciplines of geography and allied fields. The demands for skilled work force in these fields continues to expand in industries, business, and government, both locally and nationally. The Internet has paved the way for different types of archived and present data to be available to the public and government in a timely manner. With globalization, employers are looking for people who are skilled in the above fields. An intricate combination of several factors such as growing and changing world economy, changing environment, mobility of multinational corporations, and data availability through various sources have created a major demand for remote sensing and GIS techniques. The specialized courses in remote sensing, GIS, and advanced cartography are designed for students who are interested in handling various types of spatial data.

The Department of Geography is equipped with leading software in remote sensing, GIS and cartography. The department's experienced faculty members can accommodate the needs of students with varied interests.

## **Admission requirements**

Applicants must meet the admission requirements of the Graduate School.

## **Degree requirements**

Requires 30 hours including the research requirement. Undergraduate deficiencies must be fulfilled as needed. Specialized programs apply state-of-the-art technologies such as remote sensing, geographic information systems, and advanced cartography in various subdisciplines of geography, atmospheric science, and allied sciences. The requirements are flexible and allow students to arrange programs of study that will serve as a basis for further graduate study; as preparation for positions in industry, business, and government; or as a way to meet the immediate and changing needs of teachers and educators.

## **Course requirements**

All students must complete 9 semester hours of core courses, 15 semester hours of directed electives, and 6 semester hours of Thesis (THES 698).

PREFIX NO SHORT TITLE CR HRS

Core requirements

GEOG	610	Geog Thought	3
	615	Res Methods	3
	618	Quant Geog	3

Directed electives, 15 hours

Directed	ciccu	
GEOG	525	Phys Meteor (3)
	530	Wea Analysis (3)
	531	Glob Climate (3)
	532	Clim Change (3)
	534	Atmos Hazard (3)
	535	Satrad Meteo (3)
	540	Cart Vis 1 (3)
	542	Intr Rem Sen (3)
	543	Adv Rem Sens (3)
	544	Adv GIS Anly (3)
	545	GIS App Desg (3)
	546	Sem Rem Sen (3)
	547	Thermo Meteo (3)
	548	GIS Sys Desg (3)
	549	Synop Meteor (3)
	550	Sev Loc Stor (3)
	551	Dynamic Mete (3)
	570	World Pol Ge (3)
	590	F Obs Sev LS (6)
	614	Prob Tch ES (3-6)
	620	Seminar Geog (3)
	625	Spl Tps GIS (3-6)
	630	Spl Tps Cart (3-6)

635	Spl Tps R S (3-6)	
640	Spl Tps Atmo (3)	
680	D A Field St (1-6)	
690	Prof Intern (1-3)	
695	Rdgs Sp Stud (1-3)	15

Thesis requirement

THES 698 Thesis (1-6)

6

30 hrs

## **MINOR IN GIScience**

PREFIX NO SHORT TITLE CR HRS

Core requirements, 6 hours

GEOG	542	Intr Rem Sen	3
	544	Adv GIS Anly	3
9 hours f	from		
GEOG	543	Adv Rem Sens (3)	

- 545 GIS App Desg (3)
- 546 Sem Rem Sen (3)
- 548 GIS Sys Desg (3)
- 625 Spl Tps GIS (3-6)
- 635 Spl Tps R S (3-6)

15 hrs

9

## **GEOGRAPHY** (GEOG)

**525** Physical Meteorology. (3). Study of the physical processes of the atmosphere with a focus on solar and terrestrial radiation, clouds, and precipitation.

*Prerequisite:* GEOG 330 or 530; MATHS 165; PHYCS 120 or permission of the instructor. *Not open to* students who have credit in GEOG 425.

**530 Weather Analysis.** (3) Presentation and practice of synoptic- and meso-scale diagnostic analysis techniques, including a review of satellite and radar remote sensing systems and image interpretation. Introduction to numerical weather prediction.

Prerequisite: GEOG 230 or equivalent.

**531 Global Climate. (3)** Introduction to the dynamics of the global climate system. Emphasizes the physical processes that force spatial variability in climate, and the feed-back mechanisms associated with global teleconnections and climate change.

Prerequisite: GEOG 330 or 530.

**532 Climate Change and Modification. (3)** Study of the variability of climate over time and space, and factors involved. Focuses on past climates, modeling of future climates, and modification at local or microscale.

*Prerequisite:* GEOG 230 or permission of the instructor. *Not open to* students who have credit in GEOG 332.

**534 Atmospheric Hazards. (3)** Examination of the causes, consequences, and spatial distribution of hazards deriving from or impacting the atmosphere. Both the physical properties and processes of natural hazards (e.g. hurricanes, tornadoes, biochemical) and the human actions and reactions to these hazards will be emphasized at the local, regional, and global scales.

*Prerequisite:* GEOG 101 or GEOL 101 or permission of the instructor. *Not open to* students who have credit in GEOG 334.

**535 Satellite and Radar Meteorology. (3)** Study of the platforms and sensors of satellite and radar remote sensing systems used in meteorology and climatology. Emphasis is on satellite and radar products and their interpretation.

*Prerequisite:* GEOG 330 or 530; MATHS 165; PHYCS 120; or permission of the instructor. *Not open to* students who have credit in GEOG 435.

**540 Cartography and Visualization of Spatial Data.** (3) Introduction to cartographic methods for the visualization and analysis of geographic phenomena. Principles of design are stressed with particular emphasis on methods for symbolizing point, line, and area elements, and the principles and use of color in cartography. Students produce publication quality maps using an industry standard software.

Not open to students who have credit in GEOG 340.

**542 Introduction to Remote Sensing. (3)** Principles of remote sensing and its applications on Earth resources. Topics include the physics of remote sensing, aerial photo interpretation, photogrammetry, multispectral, hyperspectral, thermal infrared remote sensing, RADAR/LIDAR, remote sensing of vegetation, water, and soils.

Not open to students who have credit in GEOG 342.

**543** Advanced Remote Sensing. (3) Digital image processing techniques utilized to analyze remotely sensed data. Topics include remote sensing data collection, image pre-processing, image enhancement, image classification, post classification analysis, and multi-temporal data analysis for change detection.

*Prerequisite:* GEOG 542. *Not open to* students who have credit in GEOG 343.

**544 Advanced Geographic Information Systems Analysis.** (3) Examination and use of analysis techniques in Geographic Information Systems (GIS). Introduction to basic GIS programming. Diagramming GIS logic and processing flows. Exposure to widely used GIS data models.

Prerequisite: GEOG 240, 265; or permission of the instructor.

Not open to students who have credit in GEOG 344.

**545** Geographic Information Systems Applications Design and Development. (3) Fundamentals of geographic information system (GIS) programming. Develop and implement customized GIS applications. Exposure to widely used GIS software-programming environments.

*Prerequisite:* GEOG 265, 544; or permission of the instructor.

Not open to students who have credit in GEOG 445.

**546 Seminar in Advanced Techniques in Remote Sensing. (3)** Advanced techniques applied to remotely sensed data using state-of-the-art software. Review of current methods of computer and manual interpretation techniques. Includes active participation in classroom presentations.

Prerequisite: GEOG 542, 543; or permission of the instructor.

Not open to students who have credit in GEOG 443.

547 Thermodynamic Meteorology. (3) Application of physical gas laws such as the equation of state and hydrostatic equation to investigate adiabatic processes and parcel theory as they relate to atmospheric instability and connective development.

Prerequisite: GEOG 330 or 530; MATHS 165, 166; PHYCS 120, 122 or permission of the instructor. Not open to students who have credit in GEOG 447.

548 Geographic Information System Design. (3) Principles of Geographic Information System (GIS) design. Implementation of GIS technology. Database and user-interface design. Practical experience applying advanced GIS tools to analyze spatial data. Workshop format requires student-motivated projects.

Prerequisite: GEOG 544.

Not open to students who have credit in GEOG 448.

549 Synoptic Meteorology. (3) Investigation of synoptic- and mesobeta-scale atmospheric systems, with a focus on analysis and forecasting through the use of satellite, radar, and numerical weather predication technology.

Prerequisite: GEOG 330 or 530; MATHS 165; PHYCS 120 or permission of the instructor. Not open to students who have credit in GEOG 449.

550 Severe Local Storms. (3) Survey of severe thunderstorms and tornadoes. Focuses on storm processes and the forecasting of severe local storm events.

Prerequisite: GEOG 330 or 530.

**551 Dynamic Meteorology.** (3) Study of the variables that explain four-dimensional atmospheric behavior with primary focus on synoptic-scale processes. Special attention is given to the governing equations and associated approximation and assumption relevant to numerical weather prediction.

Prerequisite: GEOG 330 or 530; MATHS 165, 166; PHYCS 120, 122 or permission of the instructor. Not open to students who have credit in GEOG 451.

570 World Political Geography. (3) Analysis of the contribution of physical and cultural characteristics of the nations of the world to foreign relations problems.

Not open to students who have credit in GEOG 470.

**590 Field Observation of Severe Local Storms. (6)** Field trip to the Great Plains region to observe severe local storms. Begins with two three-hour, on-campus lecture periods, followed by a four-week period of field observation, then concludes with three two-hour, on-campus trip-review lectures.

Prerequisite: permission of the instructor.

**610 History of Geographic Thought. (3)** Focuses on the role of geography in the evolution of the physical and social sciences. Traces paradigms from the premodern period of geography through its emergence as an academic discipline to its present-day applications and theory.

614 Problems in the Teaching of Earth Science. (3-6) Primarily for experienced teachers: discussion and solution of problems teachers have had in teaching the concepts of earth science, physical geography, and geology.

A total of 6 hours of credit may be earned.

615 Research Methods in Geography. (3) Examination of research-related topics relevant to first-year graduate study in geography. Focuses on use of the scientific method in solving geographic problems, although topics such as ethics, integrity, professionalism, philosophy, research project designs, and professional presentations are covered.

**618 Quantitative Methods in Geography. (3)** A study of quantitative techniques used in geographic research that focus on the solution of spatial problems. Emphasizes geographic and spatial data, geographic research inferences, point pattern analysis, areal association, and factor analysis in geography.

Prerequisite: MATHS 221 or equivalent.

**620 Seminar in Geography. (3)** Small group discussion of geographic problems selected by instructional staff and depending on students' interest.

A total of 6 hours of credit may be earned, but no more than 3 in any one semester or term. *Open only to* majors in geography and related fields.

**625 Special Topics in GIS. (3)** Topics chosen from current research areas in applied GIS and from advanced topics in GIS data representation. Possible topics include advanced spatial models and object modeling with geodatabases.

Prerequisite: GEOG 544, 545; or permission of the instructor.

A total of 6 hours of credit may be earned, but no more than 3 in any one semester or term.

**630 Special Topics in Advanced Cartography. (3)** Advanced study exploring contemporary research in cartographic techniques and production. Topics include trends in cartographic research, academic and commercial sources of cartographic information, and the impact of information technology. Topics vary depending on the needs of the students.

Prerequisite: GEOG 340 or 540 or equivalent.

A total of 6 hours of credit may be earned, but no more than 3 in any one semester or term. *Open only to* geography majors.

**635 Special Topics in Remote Sensing. (3)** Research in remote sensing using advanced techniques applied to a field of study such as land use, vegetation, climatology, agriculture, or environmental problems. Research activities are accompanied by presentations on advanced remote-sensing topics.

Prerequisite: GEOG 542, 543.

A total of 6 hours of credit may be earned, but no more than 3 in any one semester or term.

**640 Special Topics in Atmospheric Science. (3)** The study of a topic in atmospheric science within the expertise of the instructor. Examples include such areas as land-surface-atmosphere interactions, meso-scale meteorology, hydroclimatology, climate change, and tropical weather and climate.

Prerequisite: GEOG 530.

A total of 6 hours of credit may be earned, but no more than 3 in any one semester or term. *Open only to* majors in geography and related fields.

**653 Geography of Indiana.** (3) A geographic examination of the physical, cultural, and economic diversity of the state. Field experience with assigned projects supplements classroom activities.

**680 Distant Areas Field Studies. (1-6)** Physical, economic, and cultural geography in areas distant from the campus. Includes seminars arranged during travel.

Prerequisite: permission of the department chairperson.

A total of 12 hours of credit may be earned, but no more than 6 in any one semester or term. *Open only to* students in geography, earth science, and allied subjects.

**690** Professional Internship. (1-3) Paid or unpaid supervised field and laboratory experience in public or private agencies.

A total of 3 hours of credit may be earned.

**695 Readings and Special Studies in Geography. (1-3)** Special assigned studies in various sub-fields of geography including readings and research projects.

A total of 6 hours of credit may be earned, but no more than 3 in any one semester or term.

## **GEOLOGICAL SCIENCES**

<u>www.bsu.edu/geology</u> Fine Arts Building 117, 765-285-8270

## PROGRAMS

Master of arts (MA) and master of science (MS) in geology and master of arts (MA) in GIScience; the latter is cooperative with the Department of Geography.

See the Science listing under the College of Sciences and Humanities, page 180, for the doctoral programs in science education and philosophy in environmental science.

## **Admission requirements**

Applicants must meet the admission requirements of the Graduate School and have cumulative undergraduate grade-point averages (GPA) of at least 2.75 overall or 3.0 for their junior and senior years and Graduate Record Examination (GRE) scores of at least 470 verbal, 530 quantitative, and 520 analytical (or an acceptable combination of GPA and GRE scores). Candidates must have completed acceptable geology field courses as undergraduates or must complete a Ball State field course as part of the master's requirements.

## MASTER OF ARTS IN GEOLOGY

## **Degree requirements**

Requires 30 hours of graduate courses, and passing the following National Association of State Boards of Geology (ASBOG) tests: the Fundamentals of Geology Examination and the Practice of Geology Examination. Each student must register for the 1-credit Research Colloquium during each Fall and Spring Semester of full-time graduate study.

## PREFIX NO SHORT TITLE CR HRS

Geology seminar requirement, 9 hours from GEOL 605 Sem Strat (3) 610 Sem Sediment (3) 626 Sem Tectonic (3) 660 Sem Hydrogeo (3) 670 Sem Geochem (3) 671 Sem Geomorph (3) 9

Research methods requirement

GEOL 685 Geo Res Meth

3

Approved graduate electives in<br/>geology, including up to three<br/>counted credits fromGEOL500Res Colloq9Approved major or minor in a<br/>second discipline or GEOL and/or<br/>other approved electives9

30 hrs

## MASTER OF SCIENCE IN GEOLOGY

## **Degree requirements**

Requires 30 hours of graduate courses. Each student must register for the 1-credit Research Colloquium during each Fall and Spring Semester of full-time graduate study, and write a thesis, which fulfills 6 hours of the 30-hour requirement. In a normal course of study, students are required to determine the thesis topic by the end of the second semester. The completed thesis document is subject to approval by the committee following a public oral defense.

PREFIX NO SHORT TITLE CR HRS

Geology seminar requirement,

9 hours from

GEOL	605	Sem Strat (3)	
	610	Sem Sediment (3)	
	626	Sem Tectonic (3)	
	660	Sem Hydrogeo (3)	
	670	Sem Geochem (3)	
	671	Sem Geomorph (3)	9
Thesis re	quiren	nent	
THES	698	Thesis (1-6)	6
Approve	d grad	uate electives in	
geology.	includ	ling up to three	
counted of	credits	from	
GEOL	500	Res Colloq	6
Approve	d majo	or or minor in a	
second d	iscipli	ne or GEOL and/or	
other app	proved	electives	9

30 hrs

## **GEOLOGY (GEOL)**

**500 Research Colloquium.** (1) Presentations on geological science research topics by faculty, students, and visiting professional speakers. Enrolled by every departmental graduate degree candidate, each semester in residence.

A total of 8 hours of credit may be earned, but no more than 1 in any one semester or term.

**502** Global Positioning System Techniques. (1) Global Positioning System (GPS) surveying and mapping techniques. Overview of satellite and system technology, examination of various GPS units available for applications, techniques using units individually or in combination for mapping and navigation, differential GPS methods, use in computer-generated maps.

Prerequisite: permission of the department chairperson.

A total of 3 hours of credit may be earned, but no more than 1 in any one semester or term.

**508 Sedimentary Geology. (3)** An introduction to the study of sedimentary rocks and processes. Sedimentary rock description, depositional environments, and the application of stratigraphic methods. Regularly scheduled laboratory and a field trip.

*Prerequisite:* GEOL 201 or permission of the department chairperson. *Not open to* students who have credit in GEOL 308.

**509 Micropaleontology. (3)** Morphology, classification, preparation techniques, and evolution of paleontologically significant microfossil groups and their biostratigraphic and paleoecologic significance. Emphasizes foraminifera, conodonts, and ostracodes. Regularly scheduled laboratory. Includes an immersion experience.

*Prerequisite:* GEOL 508 or permission of the department chairperson. *Not open to* students who have credit in GEOL 409.

**510 Igneous and Metamorphic Petrology.** (3) Origin and description of igneous and metamorphic rocks. Incorporates information on recent advances in our understanding of these rocks. Provides an overview of the field of petrology and a solid foundation for more advanced studies.

Prerequisite: GEOL 220 or permission of the department chairperson.

Not open to students who have credit in GEOL 310.

**511 Advanced Igneous and Metamorphic Petrology.** (3) Processes responsible for, and the rocks and minerals associated with, the formation of both igneous and metamorphic rocks. Microscopic to macroscopic features associated with these processes. Regularly scheduled laboratory.

Prerequisite: GEOL 510 or permission of the department chairperson.

Not open to students who have credit in GEOL 411.

**512 Sedimentary Petrology. (3)** A petrographic approach to the classification and genetic interpretation of sedimentary rocks. Terrigenous sandstones and carbonate rocks will be emphasized with lesser stress on mud rocks and noncarbonate chemical rocks.

*Prerequisite:* GEOL 201, 220, 310, or permission of the department chairperson. *Not open to* students who have credit in GEOL 412.

**516 Geology of Hazards and the Environment. (3)** Applied geology for hazard and environmental problems. Properties and mechanics of rocks and soil; geologic materials in construction; erosion, mass wasting, subsidence, flooding, shoreline, seismic, volcanic, and other natural hazards. Dams, tunnels, mines, shoreline structures, and other special construction problems; groundwater engineering problems.

*Prerequisite:* an introductory course such as GEOL 101, 207, 240; NREM 211 or EMHS 352; MATHS 108 or high school equivalent, or permission of the department chairperson.

Not open to students who have credit in GEOL 416.

**520 Oceanography.** (3) Description of geological and physical characteristics of the oceans, marine processes, and related topics.

*Prerequisite:* GEOL 201, 207; CHEM 111, or permission of the department chairperson. *Not open to* students who have credit in GEOL 420.

**525 Geophysics.** (3) An introduction to the physics of the earth and the geophysical sciences. Refraction and reflection seismology, magnetic, electrical, gravity, radioactivity, and geothermal methods are included in lecture topics, laboratory exercises, and field investigations. Emphasizes the application of geophysical methods to energy, mineral and ground-water exploration, site evaluation, pollution detection, and other applied problems.

Not open to students who have credit in GEOL 425.

**535 Sequence Stratigraphy. (3)** Principles and practices of sequence stratigraphy. Use of surface and subsurface stratigraphic data in the reconstruction of depositional sequences and records of sea-level change. Includes an immersion experience.

Prerequisite: GEOL 508 or permission of the department chairperson.

Not open to students who have credit in GEOL 435.

**545 Fractals in the Natural Sciences.** (3) Fractal geometric models and data analysis methods of practical use in the sciences. Application examples drawn from geosciences and other natural science fields. Divider, box, size-number, variogram, and rescaled range methods, along with other techniques. Discussion of chaos and self-organized criticality as possible sources of fractals in nature.

Prerequisite: MATHS 108.

Not open to students who have credit in GEOL 445.

**550** Geology of Indiana. (3) Rocks, structure, fossils, landforms, economic resources, and geologic history of Indiana. Designed for students, particularly teachers, not majoring in the earth sciences. Field-trip oriented with collection of rock, mineral, and fossil specimens.

A total of 6 hours of credit may be earned, but no more than 3 in any one semester or term. *Not open to* students who have credit in GEOL 450.

**560 Hydrogeology.** (3) Occurrence and movement of surface water and groundwater, with special reference to the geologic environment.

*Prerequisite:* GEOL 201 or 207 or 240 or NREM 211; MATHS 108 or high school equivalent; or permission of the department chairperson.

Not open to students who have credit in GEOL 360.

**570 Groundwater Geochemistry. (3)** Introduces the processes controlling the composition of natural waters: streams, lakes, oceans, and near-surface ground-waters. Focuses on the effects of human activities, biological systems, and inorganic geochemistry processes on water chemistry.

*Prerequisite:* GEOL 101; CHEM 111, 112; or permission of the department chairperson. *Not open to* students who have credit in GEOL 470.

**571 Volcanology and Volcanic Hazards. (3)** Designed to give middle- and upper-level students a working knowledge of the causes and effects of the various types of volcanism ranging from quiescent Hawaiian-style volcanoes to the explosive Southwest Pacific volcanoes. In addition, looks at volcanic prediction, monitoring, and hazard response programs.

Prerequisite: GEOL 201 or permission of the department chairperson.

**575** Glacial Geology. (3) In-depth study of the physical nature of glaciers, their deposits, and the erosional and depositional landforms they create. Introduction to the glacial history of the north central United States. Term paper required.

*Prerequisite:* GEOL 240; PHYCS 110 or 120; or permission of the department chairperson. *Not open to* students who have credit in GEOL 475.

**580 Special Studies and Field Problems.** (1-3) Selected detailed geologic problems under the guidance of a qualified instructor.

Prerequisite: permission of the department chairperson.

A total of 6 hours of credit may be earned, but no more than 3 in any one semester or term.

**583 Field Geology.** (6) A capstone experience applying field techniques to the resolution of geologic problems. Group and individual projects include accumulation and interpretation of field observations and preparation of geologic maps, cross sections, and stratigraphic sections to answer geologic questions. Five-week summer field course in the Rocky Mountains.

Prerequisite: GEOL 201, 220, 240, 508, 590; or permission of the department chairperson.

**585** Group Field Research Experience. (3-6) Mentored, intensive, independent and/or collaborative research experience in a group setting, at an off-campus location.

Prerequisite: permission of the department chairperson.

A total of 12 hours of credit may be earned, but no more than 6 in any one semester or term. *Not open to* students who have credit in GEOL 485 same topic.

**590** Computer Applications in the Geosciences. (1) Survey of the various computer applications in the geosciences. Designed to supplement existing geoscience and computer science courses by providing opportunity to gain experience in working with BASIC and FORTRAN programs in various geoscience data collection, calculation, and graphic display applications.

A total of 3 hours of credit may be earned, but no more than 1 in any one semester or term. *Not open to* students who have credit in GEOL 290.

**599X Experimental Elective Course. (1-6)** Experimental new specialty course in the geological sciences. Topic and mode of instruction vary by semester of offering.

A total of 9 hours of credit may be earned, but no more than 6 in any one semester or term. *Not open to* students who have credit in GEOL 499X same topic. *Open only to* students with at least junior status.

**600 Seminar in Geology. (1-3)** Review and discussion of the literature related to a selected topic of current interest in geological research. Laboratory work and field trips may be included when necessary.

A total of 9 hours of credit may be earned, but no more than 3 in any one semester or term.

**601 Seminar in Environmental Geology. (1-3)** Review and discussion of the literature related to a selected topic of current interest in environmental geology. Laboratory work and field trips may be included when necessary.

A total of 6 hours of credit may be earned, but no more than 3 in any one semester or term.

**605 Seminar in Stratigraphy. (3)** Discussion of current topics in stratigraphy. Subjects may include global correlation, the record of sea level change, and global events in earth history.

**610 Seminar in Sedimentary Petrology. (3)** Advanced coverage of sedimentary rocks, their constituents, their environments of deposition, and the diagenetic processes that alter them after deposition. Proficiency in recognition of sedimentary constituents, in naming sedimentary rock types, and in interpretation of depositional, diagenetic, and provenance processes is expected.

Prerequisite: GEOL 412 or 512 or permission of the instructor.

**611 Regional Geology. (3)** Geologic history, geomorphology, structural geology, and special geologic topics of selected regions.

**626 Seminar in Tectonics. (3)** Origin and nature of tectonic processes affecting the crust and lithosphere. Plate dynamics and the tectonic evolution of orogens from a structural, petrologic, and geochronologic perspective.

Prerequisite: GEOL 315, 411, or 510 or permission of the instructor.

**660 Seminar in Advanced Hydrogeology. (3)** Seminar in advanced and contemporary topics in groundwater geology, such as pump and slug test analyses, analytic or numerical flow and transport computer modeling, wellhead protection policy, current groundwater resource and water quality research, and groundwater remediation.

Prerequisite: GEOL 360 or 560; permission of the department chairperson.

**670 Seminar in Environmental Geochemistry. (3)** Seminar in advanced and contemporary topics in aqueous geochemistry such as geochemical cycling with focus on the role of sediments, soils, freshwater streams and lakes, and oceans as reservoirs for chemical compounds, including natural and manmade contaminants.

Prerequisite: GEOL 470 or 570 or permission of the department chairperson.

**671 Seminar in Geomorphology. (3)** Review and critical discussion of key classic and recent literature in geomorphology. Student presentations and group project.

**680 Special Studies and Field Problems.** (1-3) Selected detailed geologic problems under the guidance of a qualified instructor.

Prerequisite: permission of the department chairperson.

A total of 6 hours of credit may be earned, but no more than 3 in any one semester or term.

**685** Geology Research Methods. (3) Introduction to the use of scientific literature, design of research, analysis of data, and writing of research/grant proposals in a focused area of the geosciences. Review of literature pertinent to a special topic of student interest.

## HISTORY

<u>www.bsu.edu/history</u> Burkhardt Building 200, 765-285-8700

## PROGRAMS

The master of arts (MA) in history and in social science may serve as terminal degrees or as preludes to additional graduate degrees. In addition, either of the two degrees may be used to professionalize the standard secondary school teaching license. See Social Studies, page 183.

## MASTER OF ARTS IN HISTORY

## **Admission requirements**

Students must apply to and meet the admission requirements of the Graduate School. Students also must apply separately to the Department of History. All applicants must submit to the director a resume or curriculum vitae, original copies of all official undergraduate transcripts, a writing sample (typically their best undergraduate history paper), and a 300-500 word statement concerning goals and interests.

Applicants normally should have earned at least a 3.0 grade-point average (GPA) on a scale of 4.0 in a minimum of 18 semester hours in undergraduate history courses. To qualify for a graduate assistantship in the department, applicants must take the Graduate Record Examination (GRE) general test and ordinarily have an undergraduate GPA of at least 3.0 on a scale of 4.0.

#### **Degree requirements**

PREFIX NOSHORT TITLECR HRSRequired CoreHIST612Sem Historio3

HIST	012	Sem Historio	3
	613	Sem Hist Res	3

#### **Directed electives**

A minimum of five courses in American, European, and/or world history distributed over a minimum of two areas. Students must select from the following courses:

American History HIST 621 At

621	Amer to 1877 (3)
622	Amer frm 1877 (3)
623	Spec Top Am (3-6)

## European History

HIST 631 Std Erly Eur (3) 632 Std Mod Eur (3) 633 Spec Top Eur (3-6)

World History

HIST 641 Std Wrld His (3) 15

Two 500- or 600-level courses in history or with approval in related fields

6

27 hrs

6

Thesis option

Any student may choose to write a thesis. The history department strongly recommends that students who intend to continue their graduate education at the doctoral level write a thesis. THES 698 Thesis (1-6) 6 or *General option* Students who choose not to write a

thesis must complete 6 additional hours of 600-level course work in lieu of a thesis. 600-level course work

## 33 hrs

## **MA Examination**

All students must take a three-hour written examination in a field in one of three geographic areas. The written exam is followed by a one-hour oral examination. Students must take at least three courses (9 hours) in the MA exam field, at least two of which (6 hours) must be at the 600 level. Students will complete at least two courses (6 hours) in a complementary field from a different geographic area. At least one of those courses (3 hours) must be at the 600 level. In the course of completing the 6 hours in his or her complementary field, the student must complete an essay of approximately 20 pages on a topic to be determined in consultation with a faculty member.

## HISTORY (HIST)

**500 Colonial America, 1492-1756. (3)** The settlement of North America by the British and the evolution of the distinctive colonial societies that formed the foundations of the United States. *Not open to* students who have credit in HIST 400.

**501 The American Revolution, 1756-1789.** (3) Transformation of American society and politics in the era of the American Revolution with emphasis on the origins of the revolution, the development of a democratic society, and the Constitution of the United States.

Not open to students who have credit in HIST 401.

**503 The Rise of Nationalism in the United States, 1789-1824.** (3) The foundations of the United States as a new nation with emphasis on the major social, political, economic, and diplomatic events of the period.

Not open to students who have credit in HIST 403.

**505** Nationalism versus Sectionalism in the United States, 1820-1860. (3) The major social, political, economic, and cultural developments in the United States with emphasis on the major leaders and events involved in the sectional conflict leading to the Civil War, 1820-1860.

Not open to students who have credit in HIST 405.

**507** The American Civil War and Reconstruction. (3) Events, leaders, and movements, with special emphasis on causes, interpretation, and historiography of the period of national crisis and war followed by national reconstruction.

Not open to students who have credit in HIST 407.

**509 Progressivism and Imperialism: The United States, 1878-1918.** (3) America's rise to world significance at home and abroad between 1878 and 1918; the political, social, and economic problems and various efforts at reform.

Not open to students who have credit in HIST 409.

**510 Introduction to the History of Business in the United States.** (3) An historical examination of American business from colonial times to the present.

Not open to students who have credit in HIST 310.

Open only to graduate students.

**511 The United States from World War I through World War II.** (3) An examination of the reaction of the American people to a society changing rapidly under the impact of two major wars, the Great Depression, and continuing industrialization and urbanization.

Not open to students who have credit in HIST 411.

**513 Recent United States History: 1945 to the Present. (3)** The role of the United States in the modern world. Examines the efforts of Americans to preserve a society that is prosperous and humane while it adjusts to technological change and continuing social and intellectual ferment.

Not open to students who have credit in HIST 413.

**515 History of Indiana. (3)** Exploration, colonization, and development of the state from the earliest time to the present.

*Prerequisite:* 6 hours of credit in United States history. *Not open to* students who have credit in HIST 415.

**516 History of the Antebellum South. (3)** History, institutions, political themes, and problems of the antebellum South.

Not open to students who have credit in HIST 416.

**517 History of the New South. (3)** Reconstruction, industrial and agricultural progress, social life, and the new leadership after 1865.

Not open to students who have credit in HIST 417.

**519 The Trans-Mississippi Frontier. (3)** American territorial expansion in the region west of the Mississippi River, with emphasis on the nineteenth century. Exploration, the movement of settlers, the events that influenced their migration, and the effect of these events and the frontier on national development.

Not open to students who have credit in HIST 419.

**520 The African American Experience in America. (3)** The African American experience in America from the sixteenth century to the present. Emphasizes the effect of African Americans on American culture and vice versa.

Not open to students who have credit in HIST 210.

**521 Indians in United States History. (3)** Indian and white relations from 1492 to the present; the Indian wars, treaty making, various types of Indian and Caucasian interaction, and the development of federal and state Indian policy.

Not open to students who have credit in HIST 421.

**529 Colloquium in Latin American History. (3-6)** Selected topics in the history of Mexico, the Caribbean, and the Spanish borderlands.

A total of 6 hours of credit may be earned.

**530 United States Diplomatic History to 1914. (3)** History of United States diplomacy from the late colonial period to the eve of World War I.

Not open to students who have credit in HIST 430.

**532 United States Diplomatic History Since 1914.** (3) The foreign relations of the United States since the outbreak of World War I.

Not open to students who have credit in HIST 432.

**533 American Life and Thought, 1607-1865.** (3) American social, intellectual, and cultural history from the colonial period to the Civil War, including such topics as religion, women, the family, ethnic groups, minorities, the arts, thought, popular culture, and everyday life.

Not open to students who have credit in HIST 433.

**534 American Life and Thought, 1865 to the Present. (3)** American social, intellectual, and cultural history from Reconstruction to the present, including such topics as religion, women, the family, ethnic groups, minorities, the arts, thought, popular culture, and everyday life.

Not open to students who have credit in HIST 434.

**535** American History through Film. (3) Introduces the techniques needed to analyze films as primary documents in United States history. Focuses on the most significant feature and documentary films of American society. Compares and contrasts filmic and historical reality.

Not open to students who have credit in HIST 435.

**538 Colloquium on United States Urban History. (3)** The literature of American urban history, presented topically rather than chronologically. Students will select readings from a list compiled especially for the course and tailored to the exact number of students. They will then discuss their own special assignments each week so that greater exposure and interchange will be possible.

**541 Comparative Slavery.** (3) Explores the types of bondage, unfree labor systems, and slavery and the slave trade throughout African history as well as in a number of geographical regions for comparison. Includes Africa, the Mediterranean, the Caribbean, and Central and South America.

Prerequisite: permission of the department chairperson.

Not open to students who have credit in HIST 441.

**549** American Culture Field Studies. (3-6) American culture, its art, economic life, educational systems, geography, history, industry, languages, music, and society. Students will travel through designated areas in North America. Before the trip, considerable reading in various fields pertinent to the course will be required. At the conclusion, papers will be required.

A total of 6 hours of credit may be earned.

Not open to students who have credit in HIST 449.

**553 Modern Western Culture. (3-6)** Selected studies in the development of cultural and intellectual movements in the fine arts, literature, scholarship, political and economic thought, science, and social reform from the eighteenth century to the present. Emphasizes themes and problems of major significance.

A total of 6 hours of credit may be earned.

**554 The Era of World War I, 1870-1918.** (3) The background, immediate causes, and course of the First World War with special attention to nationalism, the alliance system, imperialism, militarism, and conflicts of interest and aspirations.

Not open to students who have credit in HIST 454.

**555 The Era of World War II, 1918-1945.** (3) The origins, immediate causes, and the course of the Second World War with stress on the peace settlement of 1919, revisionism, diplomatic conflicts, and the foundations of the postwar world.

Not open to students who have credit in HIST 455.

**556 Cold War and Europe Since 1945. (3)** European origin of the Cold War and rebirth of a "new" but divided Europe with stress on East-West conflict, power blocs, international relations, and temporary

decline of European influence; ideological, political, economic, and social development, including competition between Western and Sovietized Eastern Europe.

Not open to students who have credit in HIST 456.

**558 Strategy and Diplomacy of the European Great Powers Since 1860.** (3) Examines, interprets, and evaluates British, German, Russian, French, Italian, and Austrian strategy and diplomacy—and economic, geographic, ideological, and military foundations of national power—focusing upon the "German Question," Eurocentrism, imperialism, two world wars, renewed multipolarity, the European Community, and the Cold War.

Not open to students who have credit in HIST 458.

**559** The Jews in Europe and the Middle East, **1098** to the Present. (3) Survey of the Jewish role in European and Middle Eastern history and society. Focus will be on the commonalities and differences among Judaism, Christianity, and Islam and changing attitudes toward the Jewish community in the nineteenth and twentieth centuries.

Not open to students who have credit in HIST 459.

**560 Selected Topics in American Military History. (3)** A selected topics course covering American Military History.

A total of 6 hours of credit may be earned, but no more than 3 in any one semester or term. *Not open to* students who have credit in HIST 360. *Open only to* graduate students.

**561 Development of Greek Civilization. (3)** Greek political, social, and intellectual development in the Hellenic and Hellenistic periods. Emphasizes the rise and fall of Greek democracy and Greek contributions to the civilizations and cultures of the West.

Not open to students who have credit in HIST 461.

**562 Development of Roman Civilization.** (3) Political, social, and intellectual development of Rome from the beginning of the republic to approximately AD 500. Emphasizes development of Roman characteristics during the republic, effects of Greek ideas and imperial expansion, and Roman contributions to Western civilization.

Not open to students who have credit in HIST 462.

**564 Development of Byzantine Civilization. (3)** Political, socioeconomic, and intellectual development of the Byzantine Empire from its origins to 1453. Emphasizes Byzantine religious and cultural contributions and relations with Western Europe, the Slavic peoples, and the Muslim world.

Not open to students who have credit in HIST 464.

**565 Medieval Ideas and Institutions. (3)** Selected problems concerning the social and cultural bases of medieval civilization. Emphasizes six major institutions and themes—feudalism, chivalry, manorialism, the medieval city, the church, and the medieval university.

**567 The Renaissance and Reformation, 1300-1600. (3)** Specialized study of the crises, changes, and cultural achievements of Europe in an age of transition and intellectual upheaval. Individual investigations combined with a colloquium approach.

**569 World Civilizations**—**Field Studies. (3-6)** World civilizations—their history, art, economic life, educational systems, geography, industry, languages, music, and society—through varied travel programs. Advance reading and a summary paper are required to complement each year's travel program.

Prerequisite: permission of the department chairperson.

A total of 6 hours of credit may be earned. *Not open to* students who have credit in HIST 469.

**571 France Since 1815.** (3) The political, intellectual, and social development of modern France—the problems of revolution and reaction, imperial growth, republican reform and stabilization, state power and individual freedom, capitalism, and socialism.

Not open to students who have credit in HIST 471.

**572 France—The Classical Age, 1461-1715. (3)** The foundations and institutions of French absolutism through Louis XIV—classic culture, the monarchy, the aristocracy, the bourgeoisie, Gallican Catholicism—with emphasis on development of the ancient regime and French influence on Europe.

Not open to students who have credit in HIST 472.

**573 French Revolutionary and Napoleonic Eras, 1715-1815.** (3) Investigations of the causes of the French Revolution—the great turning point of modern civilization—with particular stress on nationalism, authority, individual freedom, reform measures, social change, and other significant forces. *Not open to* students who have credit in HIST 473.

575 Britain 1485-1714 (3) A survey of the political social and economic his

**575 Britain, 1485-1714. (3)** A survey of the political, social, and economic history of England in the Tudor and Stuart periods. Emphasizes the rise of the national state, religious conflicts, the development of the power of Parliament, and overseas exploration and colonization.

Not open to students who have credit in HIST 475.

**576 Britain, 1714 to the Present. (3)** Survey of the many changes in British life from the Hanoverian period to the present—modernization of political institutions, evolution of the limited monarchy, industrialization and social conflict, effects of imperialism and recent wars, problems of government and society since World War II.

Not open to students who have credit in HIST 476.

**577 Topics in English Constitutional History.** (3) Selected topics concerning the constitutional history of England, such as the development of the kingship, the common law, Parliament, the Tudor and Stuart theories of government, the cabinet system, and political parties.

Not open to students who have credit in HIST 477.

**581 Modern Germany.** (3) Critical problems in modern German history with concentration on unification and the age of Bismarck, the First World War, cultural and intellectual ferment, Hitler and the Nazi period, and postwar West and East Germany.

Not open to students who have credit in HIST 481.

**582 Research on the History of the Celtic Peoples.** (3) Surveys the entire chronological and geographical framework of the history of the Celtic peoples and their distinctive and persistent culture. Introduces recent scholarship and graduate-level research on a topic of the student's choice.

Not open to students who have credit in HIST 482.

**583 Research in Irish History. (3)** Surveys the entire span of Irish history and introduces recent historiography and graduate-level research on a topic of the student's choice. *Not open to* students who have credit in HIST 483.

**584 Southern Africa. (3)** Explores the arrival of the Europeans in the southern tip of Africa from 1652 and focuses on the subsequent four centuries of colonial domination of much of the southern African continent. Also investigates Black, Indian, and Colored resistance.
*Prerequisite:* permission of the department chairperson. *Not open to* students who have credit in HIST 484.

**586 Russian Civilization Before 1917: From Kievan Rus to Imperial Russia.** (3) Surveys the political, social, and cultural history of Russian civilization from its origins in the ninth century under the first political organization of the East Slavic tribes, known as Kievan Rus, to the collapse of the Russian Empire in March 1917.

**587** Soviet and Post-Soviet History. (3) Surveys the political, social, and cultural history of the Soviet Union within the broader context of events before and after the breakup of the USSR to the present.

**588 History of South Asia. (3)** Descriptive and analytical survey of the subcontinent of South Asia, comprising India, Pakistan, Bangladesh, and Sri Lanka, from early times to the present.

Not open to students who have credit in HIST 488.

**589 History of Southeast Asia.** (3) History of the region from earliest times to the present, with special attention to the formation of the earliest civilizations; the influence of Indian, Chinese, and European cultures upon the people of Southeast Asia; and the processes of synthesis that have taken place within these civilizations through the centuries.

Not open to students who have credit in HIST 489.

**591 Topics in Middle Eastern History. (3)** Selected issues and problems in the Middle Eastern world since Muhammad. Topics may include the expansion of Islam, slavery in the Middle East, the economic and social history of the Ottoman empire, the Arab/Israeli dispute, and recent national and international crises.

Not open to students who have credit in HIST 491.

**592 History of China to 1600. (3)** Descriptive and analytical survey of China's history from earliest times to roughly AD 1600, with emphasis on the development of the dynastic tradition, Confucian-based society and culture, and China's focal point status in the pre-1600 world order.

Not open to students who have credit in HIST 492.

**593 History of Premodern Japan. (3)** Analytical survey of premodern Japanese history to ca. 1600, focusing on the ideological, political, social, economic, and cultural developments that provide a foundation for the understanding of modern Japan.

Not open to students who have credit in HIST 493.

**595 Modern China, 1600 to the Present. (3)** Descriptive and analytical survey with emphasis on China's changing role as a member of the world community, its response to increased Western contacts, disintegration of traditional order, revolutionary changes through the Republic of China and the People's Republic, and significant elements of contemporary Chinese society and culture.

Not open to students who have credit in HIST 495.

**596 Modern Japan, 1600 to the Present. (3)** Descriptive and analytical survey of political and economic developments, foreign policy, and social and cultural change in modern Japan with emphasis on conditions contributing to its rapid modernization, nationalist and expansionist movements, and dynamic postwar recovery.

Not open to students who have credit in HIST 496.

**612 Seminar in Modern Historiography. (3)** A survey of the major works in the historical literature of the past five centuries, including both European and American contributions, with special investigation of significant historians and movements in historical studies and writing.

**613 Seminar in Historical Research. (3)** Designed to further investigative skills. Focuses on the knowledge of concepts and methodology used in historical research through the intensive study of a selected topic in American, European, or world history. A research paper is required. *Prerequisite:* HIST 612; permission of the MA advisor in history.

**621 Studies in American History to 1877. (3)** Studies of selected problems in American history to 1877 with special attention to discussion of historiography and current trends in scholarship. Exact content will be announced before each offering.

**622 Studies in American History Since 1877.** (3) Studies of selected problems in American history since 1877 with special attention to discussion of historiography and current trends in scholarship. Exact content will be announced before each offering.

**623 Special Topics in American History. (3-6)** Investigation of a particular topic, problem, or issue in American history with emphasis on topics, specialties, and materials not covered in other courses. Exact content will be announced before each offering.

A total of 6 hours of credit may be earned.

**631 Studies in Early European History. (3)** Studies of selected problems in early European history with special attention to discussion of historiography and current trends in scholarship. Exact content will be announced before each offering.

**632 Studies in Modern European History. (3)** Studies of selected problems in modern European history with special attention to discussion of historiography and current trends in scholarship. Exact content will be announced before each offering.

**633 Special Topics in European History. (3-6)** Investigation of a particular topic, problem, or issue in European history with emphasis on topics, specialties, and materials not covered in other courses. Exact content will be announced before each offering.

A total of 6 hours of credit may be earned.

**641 Studies in World History. (3)** Studies of selected problems in world history with special attention to discussion of historiography and current trends in scholarship. Exact content will be announced before each offering.

A total of 6 hours of credit may be earned, but no more than 3 in any one semester or term.

**650 Special Studies. (1-6)** Directed study of special problems by individuals or groups of students. Ordinarily not available until students have earned 12 hours of graduate credit in history.

Prerequisite: permission of the department chairperson.

A total of 6 hours of credit may be earned with permission of the department chairperson.

# SOCIAL STUDIES (SS)

**650 Independent Study in Social Science Education.** (1-6) Directed study of special problems or research in social science education by individuals or groups of students. Topics to be investigated will be chosen after consultation with an instructor with special competence in the topic involved.

*Prerequisite:* permission of the department chairperson. A total of 6 hours of credit may be earned.

**670** Applying Media Resources to Social Science Education. (3) Selecting, developing, and incorporating media into a systematic plan for instruction in the social sciences. Designed to aid in the enrichment of teaching through appropriate use of instructional media.

**688** Using Community Resources in Teaching Social Studies. (3) Techniques and practice in finding, analyzing, organizing, and grading materials pertaining to political, economic, and social activities of the community and their historical development for use at the various grade levels.

**690 Selection and Organization of Social Studies Teaching Materials. (3)** Recent curriculum materials examined in the light of learning theory, methods of teaching, content emphasis, and rationale. Criteria for comparing and evaluating curriculum materials are developed.

**691 Teaching Social Studies Skills in Secondary Schools.** (3) Preparation for teaching social studies skills to meet individual and group needs. Emphasizes skills related to problem solving, critical thinking, reading and interpreting materials, using pictorial representations, and finding and using information.

**692 Teaching Social Studies Skills in Junior High/Middle Schools. (3)** Preparation for teaching social studies skills to meet individual and group needs. Emphasizes skills related to problem solving, critical thinking, reading and interpreting materials, using pictorial representations, and finding and using information.

**694 Seminar in Social Studies Curriculum and Instruction.** (1-5) Research and investigative techniques will be developed through the intensive study of a topic within the framework of social studies curriculum and instruction. Some of the topics studied are goals, methodology, content, evaluation, development and revision of curricula, and teacher education in social studies. A research paper is required.

A total of 5 hours of credit may be earned.

**695 Recent Trends in Teaching Secondary School Social Studies.** (3) Issues and teaching strategies developed in view of the findings of current research in social science education. Considers such topics as developing goals, organizational patterns, values clarification, inquiry teaching, and evaluative procedures in teaching social studies. Designed for experienced teachers.

**697 Seminar in Social Science Education.** (1-5) The discussion of current issues and research in one branch of the social studies, such as value analysis, method of inquiry, critical thinking, methods in the inner city.

A total of 5 hours of credit may be earned.

# MATHEMATICAL SCIENCES

www.bsu.edu/math Robert Bell Building 465, 765-285-8640

PROGRAMS

Master of arts (MA) in actuarial science, in mathematics, in mathematics education, and in statistics; master of science (MS) in mathematics

See the Science listing under the College of Sciences and Humanities, page 180, for the doctoral programs in science education and philosophy in environmental science.

# MASTER OF ARTS IN ACTUARIAL SCIENCE

The master's program in actuarial science provides training for careers that involve analyzing and solving financial, business, and social problems related to economic risk. The program includes course work that prepares students for the professional examinations given by the Society of Actuaries and the Casualty Actuary Society.

### **Admission requirements**

Applicants must meet the regular admission requirements of the Graduate School. It is also expected that students will have had three semesters of calculus, a course in linear algebra, at least one semester of probability and one semester of statistics.

### **Degree requirements**

PREFIX	NO	SHORT TITLE	CR HRS
MATHS	551	Math Finance	4
	552	Life Cont 1	4
	553	Life Cont 2	4
	557	Act Model 1	4
	559	Mod Fin Econ	3
	620	Math Stat 1	4
	659	Res Act Sci	3
	698	Exit Survey	0
6-8 hours	from		
FIN	500	Corporation (3)	
MATHS	528	Reg Time Ser (3)	
	554	Math Invest (3)	
	558	Act Model 2 (3)	
	621	Math Stat 2 (4)	
	625	Prob Theor 1 (3)	
	626	Prob Theor 2 (3)	
	627	Gen Lin Mod (4)	
	628	Comput Stat (4)	
	655	Top Act Sci (1-4)	
	658	Risk Theory (3)	
RMI	570	Risk Mgt Ins (3)	6-8
More hou	irs from	m this list will be	
required i	f cour	ses are waived due	
to underg	raduat	e or actuarial exam	1
credit.			

32-34 hrs

# MASTER OF ARTS IN MATHEMATICS

The master of arts degree in mathematics provides students with a broad graduate-level mathematical background suitable for community college teaching, for pursuing a PhD degree in the mathematical sciences, or for seeking employment in business, industry, or government.

# **Admission requirements**

Applicants must meet the regular admission requirements of the Graduate School and have an undergraduate major in mathematics or an equivalent background as determined by the Department of Mathematical Sciences.

# **Degree requirements**

PREFIX NO SHORT TITLE CR HRS MATHS 511 Abstr Alg 1 3 512 Abstr Alg 2 3 (If the undergraduate equivalent is not complete. Otherwise course substitutions in algebra will be made in conjunction with the program advisor.) MATHS 571 Real Anls 1 3 3 572 Real Anls 2 (If the undergraduate equivalent is not complete. Otherwise course substitutions in analysis will be made in conjunction with the program advisor.) MATHS 645 Topology 1 3 675 Measr Thry 1 3 677 Complx Var 1 3 3-6 hours from MATHS 516 Thry Numbers (3) 556 Oper Res (3) 562 Numer Anls 1 (3) 563 Numer Anls 2 (3) 573 Bdry Val Pbm (3) 575 PDE(3) 625 Prob Theor 1 (3) 626 Prob Theor 2 (3) 646 Topology 2 (3) 676 Measr Thry 2 (3) 678 Complx Var 2 (3) 3-6 Research component, 3-6 hours from

MATHS 689 Res Mth Stat (3)

694 Res Math Ed (3)

 THES
 698
 Thesis (1-6)
 3-6

30 hrs

# MASTER OF ARTS IN MATHEMATICS EDUCATION

The master of arts in mathematics education provides opportunities for elementary, middle school, and high school teachers to examine various issues related to the teaching and learning of mathematics while continuing to develop their own mathematical content knowledge.

### Option 1: Elementary and middle school mathematics

### **Admission requirements**

Applicants must meet the regular admission requirements of the Graduate School; hold a current elementary, middle school, or special education teaching license; and have at least one year of elementary or middle school teaching experience.

### **Degree requirements**

PREFIX NO SHORT TITLE CR HRS

Mathema	tics co	ontent, 3-12 hours	
MATHS	623	Data Anl Tch	3
And each	of the	e following unless	
the under	gradua	ate equivalent is	
complete	d		
MATHS	514	Alg Fns Tch	3
	517	Nmbr Sys Tch	3
	542	Geo Meas Tch	3
Mathema	tics ed	lucation, 9 hours	
MATHS	690	C I Math Ed	3
	694	Res Math Ed	3
	696	Act Res Meth	3
Electives	in ma	thematics or	
mathemat	tics ed	ucation, 9-18 hours	
(as appro	ved by	advisor) from	
MATHS	631	Tech Mth Tch (3)	
	632	Assmt Mth Ed (3)	
	641	Topics Geom (3)	
	671	Con Disc Tch (3)	
	680	Studies Tchg (3)	
	691	Dev Ins Math (3)	
	693	Prob & Com (3)	
	695	Learn Th Mth (3)	
	697	Lead Math Ed (3)	9-18

 $30 \ hrs$ 

# **Admission requirements**

Applicants must meet the regular admission requirements of the Graduate School; have an undergraduate major in mathematics or an equivalent background as determined by the Department of Mathematical Sciences; hold a current secondary mathematics teaching license; and have at least one year of secondary mathematics teaching experience.

# **Degree requirements**

Mathematics content, 15 hours MATHS 641 Topics Geom 3 Take each of the following unless the undergraduate equivalent is completed. MATHS 511 Abstr Alg 1 3

1111110	511	riosu riig i	5
	571	Real Anls 1	3

Electives in mathematics content, 6-12 hours (as approved by advisor) from the following (if undergraduate equivalent is not completed) MATHS 512 Abstr Alg 2 (3) 516 Thry Numbers (3)

- 560 Hist of Math (3)
- 572 Real Anls 2 (3)
- 620 Math Stat 1 (4)
- 621 Math Stat 2 (4)
- 623 Data Anl Tch (3)
- 645 Topology 1 (3)
- 675 Measr Thry 1 (3)
- 677 Complx Var 1 (3) 6-12

Mathematics education, 15 hours

- MATHS 690 C I Math Ed
  - 694 Res Math Ed 3 3
    - 696 Act Res Meth

Electives in mathematics or mathematics education, 6 hours (as approved by advisor) from

- MATHS 631 Tech Mth Tch (3)
  - 632 Assmt Mth Ed (3)
  - 693 Prob & Com (3)
  - 695 Learn Th Mth (3)
  - 697 Lead Math Ed (3) 6

30 hrs

3

# MASTER OF ARTS IN STATISTICS

The master's program in statistics provides students with the background suitable for employment as a statistician in business, industry, or government. The degree also provides suitable preparation for pursuing a PhD degree in statistics.

# **Admission requirements**

Applicants must meet the regular admission requirements of the Graduate School. It is also expected that students will have had three semesters of calculus and a course in linear algebra.

### **Degree requirements**

PREFIX	NO	SHORT TITLE	CR HRS
MATHS	522	Sampling	3
	528	Reg Time Ser	3
	529	Exp Designs	3
	620	Math Stat 1	4
	621	Math Stat 2	4
	625	Prob Theor 1	3
	626	Prob Theor 2	3
	627	Gen Lin Mod	4
	628	Comput Stat	4
	689	Res Mth Stat	3
			34 hrs

# MASTER OF SCIENCE IN STATISTICS

The master of science in statistics provides students with the background suitable for employment as a statistician in business, industry, or government. The degree also provides suitable preparation for pursuing a PhD degree in statistics. Students pursuing the masters of science degree will be required to complete a 6-hour thesis.

### **Admission requirements**

Applicants must meet the regular admission requirements of the Graduate School. It is also expected that students will have had three semesters of calculus and a course in linear algebra.

PREFIX	NO	SHORT TITLE	CR HRS	
MATH	529	Exp Designs		3
	620	Math Stat 1		4
	621	Math Stat 2		4
	625	Prob Theor 1		3
	626	Prob Theor 2		3
	627	Gen Lin Mod		4
	628	Comput Stat		4
THES	698	Thesis (1-6)		6

3 hours from MATH 522 Sampling (3) 528 Reg Time Ser (3)

34 hrs

3

# MASTER OF SCIENCE IN MATHEMATICS

The master of science degree in mathematics provides students with a broad graduate-level mathematical background suitable for community college teaching, for pursing a PhD degree in the mathematical sciences, or for seeking employment in business, industry, or government. Students pursuing the master of science degree will be required to write a 6-hour thesis.

### **Admission requirements**

Applicants must meet the regular admission requirements of the Graduate School and have an undergraduate major in mathematics or an equivalent background as determined by the Department of Mathematical Sciences.

### **Degree requirements**

PREFIX	NO	SHORT TITLE	CR HRS
MATHS	511	Abstr Alg 1	3
(16.4	512	Abstr Alg 2	3
(If the un	dergra	duate equivalent is	
not comp	lete. C	therwise course	
substituti	ons in	algebra will be	
made in c	onjun	ction with the	
program a	adviso	r.)	
MATHS	571	Real Anls 1	3
	572	Real Anls 2	3
(If the un	dergra	duate equivalent is	1
not comp	lete. C	Otherwise course	
substituti	ons in	analysis will be	
made in c	onjun	ction with the	
program a	adviso	r.)	
MATHS	645	Topology 1	3
	675	Measr Thry 1	3
	677	Complx Var 1	3
3 hours fi	om		
MATHS	516	Thry Numbers (3)	)
	556	Oper Res (3)	
	562	Numer Anls 1 (3)	
	563	Numer Anls 2 (3)	
	573	Bdry Val Pbm (3)	1
	575	P D E (3)	
	625	Prob Theor 1 (3)	

	626 646	Prob Theor 2 (3) Topology 2 (3)	
	676 678	Measr Thry 2 (3) Complx Var 2 (3)	3
ΓHES	698	Thesis (1-6)	6
			30 hrs

# GRADUATE CERTIFICATE IN ELEMENTARY MATHEMATICS TEACHER LEADERSHIP

PREFIX	NO	SHORT TITLE	CR HRS
MATHS	514	Alg Fns Tch	3
	690	C I Math Ed	3
	697	Lead Math Ed	3
3 hours fi	om		
MATHS	517	Nmbr Sys Tch (3)	)
	542	Geo Meas Tch (3)	)

623 Data Anl Tch (3) 3

3 hours from

- MATHS 631 Tech Mth Tch (3)
  - 632 Assmt Mth Ed (3)
  - 691 Dev Ins Math (3)
  - 693 Prob & Com (3)
  - 694 Res Math Ed (3)
  - 695 Learn Th Mth (3) 3

15 hrs

### MIDDLE SCHOOL/JUNIOR HIGH MATHEMATICS LICENSE (GRADUATE LEVEL)

### **Admission requirements**

*Open only to* candidates who currently hold an elementary, middle school, or special education license. Middle school/junior high licensure in mathematics will be granted when the following criteria are met:

- completion of the following mathematics content courses with a 3.0 minimum GPA, with grade of *C*or better in 100- and 200-level mathematics content courses and grade of *C* or better in 500- and 600level mathematics content courses;
- completion of the following professional education courses with a 3.0 minimum GPA, with grade of *C* or better in all professional education courses;
- passing score on Praxis II for Middle School Mathematics; and
- Decision Point Requirements.

PREFIX NO SHORT TITLE CR HRS

Mathematics content MATHS 201 Num Alg Prob 4

	202	Dat Geo Meas	3
MATHS	161	Appl Calc 1 (3)	
	or		
	165	Calculus 1 (4)	3-4
	514	Alg Fns Tch	3
	517	Nmbr Sys Tch	3
	542	Geo Meas Tch	3
	623	Data Anl Tch	3
	631	Tech Mth Tch	3
Professio	nal ed	lucation	
EDJHM	512	Instrl Strat	3
	690	Practicum (1-9)	6
MATHS	690	C I Math Ed	3
			37-38 hrs

### **MATHEMATICAL SCIENCES (MATHS)**

**511** Abstract Algebra 1. (3) The theory of groups, including subgroups, cyclic groups, normal subgroups, cosets, Lagrange's Theorem, quotient structures, homomorphism, automorphisms, group actions, Sylow's Theorems, structure of finite abelian groups, generators, and relations.

Prerequisite: MATHS 311 or permission of the department chairperson.

Not open to students who have credit in MATHS 411.

**512** Abstract Algebra 2. (3) An introduction to the theory of rings, including integral domains, division rings, and fields. Quotient fields of integral domains. Homomorphisms, ideals, and quotient structures. Factorization in commutative rings. Polynomial rings and field extensions. Aspects of Galois theory.

Prerequisite: MATHS 411 or 511 or permission of the department chairperson.

Not open to students who have credit in MATHS 412.

**514 Algebra and Functions for Elementary and Middle School Teachers.** (3) Algebra as the study of patterns, as a symbolic language, as a tool for problem solving, as the study of functions, as generalized arithmetic, and as a way of modeling physical situations.

*Prerequisite:* at least one year of elementary or middle school teaching experience or permission of the department chairperson.

**516 Theory of Numbers. (3)** Topics include the division algorithm; positional notation; divisibility; primes; congruences; divisibility criteria; the sigma, divisor, and phi functions; Diophantine equations; linear, polynomial, and simultaneous congruences; theorems of Fermat, Euler, Lagrange, and Wilson; quadratic reciprocity.

*Prerequisite:* MATHS 215 or permission of the department chairperson. *Not open to* students who have credit in MATHS 416.

**517** Number Systems and Number Theory for Elementary and Middle School Teachers. (3) Number development, number systems, properties and characteristics of classes of numbers, number sense, number theory, operations and their relationships, and algorithms.

*Prerequisite:* at least one year of elementary or middle school teaching experience or permission of the department chairperson.

**522 Theory of Sampling and Surveys. (3)** Survey designs; simple random, stratified, cluster, and systematic sampling; ratio estimates; regression estimates; cost and variance functions.

Prerequisite: MATHS 321 or the equivalent.

**528 Regression and Time Series Models. (3)** Addresses regression topics that include simple and multiple linear regression, polynomial regression, regression diagnostics, and forecasting. Also introduces time series topics that include exponential smoothing, auto-regressive, integrated, moving average (ARIMA) models, and forecasting.

*Prerequisite:* MATHS 321 or the equivalent. *Not open to* students who have credit in MATHS 428.

**529** Analysis of Variance in Experimental Design Models. (3) Multivariate normal distribution; quadratic forms; linear models; simple random, randomized block, Latin squares, factorial, split-plot, balanced incomplete block designs; analysis of covariance; confounding; and multiple comparison tests.

Prerequisite: MATHS 321 or equivalent.

Not open to students who have credit in MATHS 429.

**542** Geometry and Measurement for Elementary and Middle School Teachers. (3) Students will develop visualization skills; identify two- and three-dimensional shapes and know their properties; connect geometry to other mathematical topics; research historical topics relevant to elementary and middle school geometry.

*Prerequisite:* at least one year of elementary or middle school teaching experience or permission of the department chairperson.

**551 Mathematics of Finance.** (4) Mathematical theory of compound interest, force of interest, annuities, equations of value, yield rates, amortization, sinking funds, bonds, market derivatives, depreciation, and current topics in finance.

*Prerequisite:* MATHS 166. *Not open to* students who have credit in MATHS 351.

**552 Mathematics of Life Contingencies 1. (4)** Survival distributions, life tables; the mathematics of life insurance, life annuities, net premiums, and net premium reserves.

Prerequisite: MATHS 321. Parallel: MATHS 551. Not once to students who have credit in MATHS 452

Not open to students who have credit in MATHS 452.

**553 Mathematics of Life Contingencies 2.** (4) Mathematics of expense loaded premiums and reserves, asset shares, multiple life functions, multiple decrement models, discrete time Markov Chain models, and simulation.

*Prerequisite:* MATHS 552. *Not open to* students who have credit in MATHS 453.

**554 Mathematics of Investments. (3)** Mathematical analysis and actuarial principles of investments and asset management.

*Prerequisite:* MATHS 320 (or 620), 351 (or 551); or permission of the department chairperson.

Not open to students who have credit in MATHS 454.

**555 Topics in Actuarial Science. (2)** Selected topics in actuarial science with emphasis on individualized study for the actuarial exams given by the Society of Actuaries and the Casualty Actuarial Society.

Prerequisite: permission of the department chairperson.

**556 Introduction to Operations Research. (3)** Optimization techniques of linear programming, dynamic programming, and integer programming. Optimal solutions of PERT-CPM networks. Optimal decision strategies.

*Prerequisite:* MATHS 162 or 166, 217 or permission of the department chairperson. *Not open to* students who have credit in MATHS 456.

**557** Actuarial Models 1. (4) Loss and frequency distributions, limited expected value, effects of inflation, parametric and non-parametric models, identification procedures for insurance company data, bootstrapping, Bayesian analysis, compound frequency, methods for censored and truncated data, classical and Bayesian credibility models, experience rating.

Prerequisite: MATHS 321 or 620.

Not open to students who have credit in MATHS 457.

**558** Actuarial Models 2. (3) Basic functions related to actuarial models, common parametric models, maximum likelihood estimation for censored or truncated data, nonparametric estimation, hypothesis testing, models with co-variables, simulation, and other topics as time permits.

*Prerequisite:* MATHS 321, 557; one year of mathematical probability and statistics. *Not open to* students who have credit in MATHS 458.

**559 Models in Financial Economics. (3)** Mathematical and economic analysis of financial instruments and the management of financial and investment risk.

*Prerequisite:* MATHS 320 (or 620), MATHS 351 (or 551), or permission of the department chairperson.

**560 History of Mathematics. (3)** The development of mathematics from pre-history to the seventeenth century. Topics may include number concepts and numeration, algebra, geometry, trigonometry, analytic geometry, and calculus.

Prerequisite: MATHS 161 or 165.

Not open to students who have credit in MATHS 460.

**562** Numerical Analysis 1. (3) Topics include error analysis, locating roots of equations, interpolation, numerical differentiation and integration, spline functions, smoothing of data. Includes programming of numerical algorithms.

*Prerequisite:* MATHS 162 or 166; MATHS 259 or CS 120; or permission of the department chairperson.

Not open to students who have credit in MATHS 362.

**563 Numerical Analysis 2. (3)** Topics include direct and iterative methods for solving systems of linear equations, eigenvalue problems; minimization of functions and linear programming. Includes programming of numerical algorithms.

*Prerequisite:* MATHS 217; MATHS 362 or 562. *Not open to* students who have credit in MATHS 363.

**568 Unpaid Professional Experience in Mathematical Sciences. (1-8)** Supervised unpaid work and learning experience as a practicing mathematician, statistician, or actuarial scientist. Practical problemsolving experience will be gained through an internship, practicum, or other such situation.

Prerequisite: permission of the department chairperson.

A total of 8 hours of credit may be earned.

A total of 8 hours of credit may be earned in MATHS 568 and 569 combined. No more than 3 hours can be counted as electives toward a departmental major or minor.

**569 Paid Professional Experience in Mathematical Sciences.** (1-8) Supervised paid work and learning experience as a practicing mathematician, statistician, or actuarial scientist. Practical problem-solving experience will be gained through an internship, practicum, or other such situation.

Prerequisite: permission of the department chairperson.

A total of 8 hours of credit may be earned.

A total of 8 hours of credit may be earned in MATHS 568 and 569 combined. No more than 3 hours can be counted as electives toward a departmental major or minor.

**571 Real Analysis 1. (3)** Properties of the real numbers. Cardinality. Topological properties of metric spaces: compactness, completeness, connectedness. Sequences and series. Continuous functions. Differential calculus of real- and vector-valued functions of one real variable.

*Prerequisite:* MATHS 215, 267; or permission of the department chairperson. *Not open to* students who have credit in MATHS 471.

**572 Real Analysis 2. (3)** The Reimann-Stieltjes integral and Fundamental Theorem of Calculus. Sequences and series of functions. Differential calculus of functions of several variables. Inverse and implicit function theorems. Extremum problems. Lebesgue integration and comparison with the Riemann integral.

*Prerequisite:* MATHS 471 or 571. *Not open to* students who have credit in MATHS 472.

**573 Boundary Value Problems. (3)** Fourier Series and integrals, heat and wave equations in one dimension, Laplace equation in two dimensions, problems in higher dimensions, and numerical methods of solving boundary value problems.

*Prerequisite:* MATHS 374. *Not open to* students who have credit in MATHS 473.

**575 Topics in Partial Differential Equations. (3)** Classical solution techniques for linear PDEs. Topics include first- and second-order equations, method of characteristics, special functions, orthogonal polynomials, transforms, Green's functions, and fundamental solutions. A computer algebra system is utilized.

*Prerequisite:* MATHS 267, 374, or permission of the department chairperson. *Not open to* students who have credit in MATHS 475.

**599 Special Studies in Mathematics. (1- 8)** Individual work under the direction of a staff member of the department will involve assigned reading and reports and may involve class attendance in related courses.

Prerequisite: permission of the department chairperson.

A total of 8 hours of credit may be earned.

**601 Workshop in Mathematics Education.** (1-12) A one- or two-week workshop addressing specific topics in mathematics education.

A total of 12 hours of credit may be earned.

**619 Special Studies in Geometry, Algebra, or Topology. (1-8)** Individual work under the direction of a faculty member of the department; will involve assigned reading and reports and may involve class attendance in related courses.

Prerequisite: permission of the department chairperson.

A total of 8 hours of credit may be earned. MATHS 619, 669, and 679, singly or in combination, may be taken for a total of no more than 8 hours of credit.

**620 Mathematical Theory of Statistics 1. (4)** Probability set functions, random variables, density and distribution functions, mathematical expectations, marginal and conditional distributions, sampling distributions, and limiting distributions. The mathematical rigor requires a strong background in calculus.

Prerequisite: MATHS 166, 215.

**621 Mathematical Theory of Statistics 2. (4)** Estimation theory and statistical tests of hypothesis. Topics include: classical and Bayesian estimation, sufficiency, completeness, uniqueness, likelihood function, exponential families, Rao-Blackwell Theorem, Rao-Cramer inequality, hypothesis testing, Neyman-Pearson Lemma, likelihood ratio tests, goodness-of-fit, contingency tables, nonparametric tests, distribution of quadratic forms, and correlation and regression, bootstrapping.

Prerequisite: MATHS 620.

**623 Data Analysis and Probability for Teachers.** (3) Students will select and use appropriate statistical methods to analyze data, develop, and evaluate inferences and predictions that are based on data, and understand and apply the basic concepts of probability.

Prerequisite: at least one year of teaching experience or permission of the department chairperson.

**625 Probability Theory and Applications. (3)** Basic probability theory, random variables, conditional probability and conditional expectation, Poisson process, interarrival time, and waiting time distributions. *Prerequisite:* MATHS 166 or equivalent.

**626 Probability and Stochastic Processes. (3)** Discrete and continuous time Markov chains, queuing theory, renewal theory.

Prerequisite: MATHS 625 or the equivalent.

**627** Generalized Linear Models with Applications. (4) Methods needed to analyze non-normal data. Topics include exponential family of distributions, an overview of generalized linear models. Models for: continuous data with constant variance, binary data, polytomous data, count data, time to events or survival data.

Prerequisite: MATHS 621 or permission of the department chairperson.

**628** Computational Methods in Statistics. (4) Theory and application of simulation techniques used in statistics. The use of statistical software such as SAS and R in statistical analysis.

Prerequisite: MATHS 620 or the equivalent.

**631 Technology for Mathematics Teachers. (3)** Modeling, computational, and communication tools used in teaching mathematics.

Prerequisite: at least one year of teaching experience or permission of the department chairperson.

**632** Assessment in Mathematics Education. (3) Issues related to assessment in mathematics education and the relationship of assessment to curriculum and instruction. Examination of various types of assessments administered in mathematics classrooms, as well as large-scale local, national, and international assessments.

Prerequisite: at least one year of teaching experience or permission of the department chairperson.

**641 Topics in Geometry. (3)** A survey of topics in contemporary geometry from various perspectives, including conjecture and exploration, formal analysis, and application beyond geometry. *Prerequisite:* MATHS 345 or the equivalent.

**645 Topology 1. (3)** Introduction to point-set topology. Topics include set-theoretic preliminaries, topological spaces, continuous functions, metric spaces, product and quotient spaces, connectedness,

compactness, countability and separation axioms, Urysohn's Metrization Theorem, Tietze's Extension Theorem, and Tychonoff's Theorem.

Prerequisite: MATHS 471 or 571.

**646 Topology 2. (3)** A second semester course in point-set topology. Stone-Cech compactification, paracompactness, metrization theorems, Ascoli's

Theorem, Baire's Category Theorem, introduction to homotopy theory, Jordan Curve Theorem, Invariance of Domain, Brouwer Fixed-Point Theorem.

Prerequisite: MATHS 645.

**655 Topics in Actuarial Science. (1-4)** Focuses on advanced studies in actuarial science. Actuarial science uses knowledge from many areas including mathematics, statistics, and finance. It also continually expands its scope to include latest developments from multiple areas. The instructor will have flexibility to determine course content.

Prerequisite: permission of the department chairperson.

A total of 4 hours of credit may be earned.

**658 Risk Theory.** (3) Individual and collective risk theory. Probability of ruin. Probability distributions of random numbers of random variables.

Prerequisite: MATHS 552.

**659 Research Seminar in Actuarial Science. (3)** Research study in actuarial subjects of current interest in life, property/casualty, health, pension, and/or financial risk management. Literature searches on selected topics. Articles from research journals may be read and discussed. Will use actuarial skills from several courses. A paper will be required. Case studies and special projects will be completed and results presented on a team basis.

*Prerequisite:* MATHS 557. *Parallel:* MATHS 553.

**660 Topics in the History of Mathematics. (3)** In-depth study of selected topics in the history of mathematics.

*Prerequisite:* MATHS 162 or 165, 460 or 560.

**669 Special Studies in Applied Mathematics. (1-8)** Individual work under the direction of a faculty member of the department; will involve assigned reading and reports and may involve class attendance in related courses.

Prerequisite: permission of the department chairperson.

A total of 8 hours of credit may be earned. MATHS 619, 669, and 679, singly or in combination, may be taken for a total of no more than 8 hours of credit.

#### 671 Continuous and Discrete Mathematics for Elementary and Middle School Teachers. (3)

Fundamental concepts and applications of calculus and discrete mathematics.

Prerequisite: MATHS 514 or permission of the department chairperson.

**675 Measure Theory and Integration 1. (3)** The concept of measurability, simple functions, properties of measures, integration of positive as well as complex functions, sets of measure zero, Riesz representation theorem, Borel and Lebesgue measures, LP-spaces, approximation by continuous functions, elementary Hilbert space theory.

Prerequisite: MATHS 472 or 572.

**676 Measure Theory and Integration 2. (3)** Banach spaces, Baire's theorem, Hahn-Banach theorem, complex measures, total variation, absolute continuity, Radon-Nikodym theorem, bounded linear functionals on LP, the Riesz representation theorem, differentiation of measures, the fundamental theorem of calculus, integration on product spaces, the Fubini theorem, completion of product measures, convolutions, distribution functions.

Prerequisite: MATHS 675.

**677 Complex Variables 1. (3)** Complex number systems, differentiation and integration, functions (analytic, entire, meromorphic) of one complex variable, singularities, complex integration, Cauchy's theorem, Cauchy's integral formula, power series, Laurent series, calculus of residues. *Prerequisite:* MATHS 471 or 571.

**678 Complex Variables 2. (3)** Analytic continuation, Riemann surfaces, theorems of Weierstrass and Mittag-Leffler, solution of two-dimensional potential problem, conformal mapping, Schwartz-Christoffel transformations and their applications.

Prerequisite: MATHS 677.

**679 Special Studies in Analysis. (1-8)** Individual work under the direction of a faculty member of the department; will involve assigned reading and reports and may involve class attendance in related courses.

Prerequisite: permission of the department chairperson.

A total of 8 hours of credit may be earned. MATHS 619, 669, and 679, singly or in combination, may be taken for a total of no more than 8 hours of credit.

**680** Special Studies in the Teaching of Mathematics. (1-6) The student will work under the direction of a staff member in the Department of Mathematical Sciences. Assigned reading and reports; possible class attendance in related courses.

Prerequisite: permission of the department chairperson.

A total of 6 hours of credit may be earned.

**689 Research Methods in Mathematics and Statistics. (3)** The scientific method in mathematical research. Location of relevant journal articles, reference books, and reviews. Development of research and problem-solving techniques. Each student will write a mathematical paper. The instructor will assist students whose work is of exceptional quality in submitting their results for publication.

**690 Curriculum and Instruction in Mathematics Education. (3)** Focuses on the mathematics curriculum, with emphasis on current issues and trends, on teaching strategies, and standards-based teaching. Looking at mathematics curriculum from a K-12 perspective, we will work on understanding these recommendations in light of previous mathematics curriculum experiences.

Prerequisite: at least one year of teaching experience or permission of the department chairperson.

**691 Developmental Instruction in Mathematics. (3)** Materials and methods used in developing conceptual understanding of mathematics for all students in elementary school, middle school, high school, and community college. Includes assessment and remediation techniques.

Prerequisite: at least one year of teaching experience or permission of the department chairperson.

**693 Problem Solving and Communication in Mathematics. (3)** Knowledge and skills for teaching and learning mathematics through problem solving. Knowledge and skills for orchestrating oral and written communication to promote mathematical reasoning in student-centered mathematics classrooms.

Prerequisite: at least one year of teaching experience or permission of the department chairperson.

**694 Research Methods in Mathematics Education.** (3) Research analysis and methodology in mathematics education.

*Prerequisite:* at least one year of teaching experience, and 18 hours of graduate credit in mathematics or mathematics education, including 690 and either 632 or 695, or permission of the department chairperson.

**695 Learning Theories in Mathematics Education.** (3) In-depth study of learning theories; discussion of the psychology of mathematics learning (i.e., what we know about the ways in which students learn mathematics). These issues will be discussed from a "teacher's perspective," looking for classroom implications of our knowledge about K-12 students' mathematical thinking.

Prerequisite: at least one year of teaching experience or permission of the department chairperson.

**696 Action Research in Mathematics Education. (3)** Teachers conduct an action research project in a mathematics classroom and present their findings in a written report.

Prerequisite: MATHS 694 or permission of the department chairperson.

**697 Teacher Leadership in Mathematics Education. (3)** Development of strategies and skills for teacher leadership in mathematics education, with a focus on models for professional development of mathematics teachers.

Prerequisite: MATHS 690, 694.

**698** Actuarial Science Exit Survey. (0) This 0-credit course consists of an exit survey that should be completed by all students who attain an MA in Actuarial Science from Ball State University. The survey will ask students about professional actuarial exams completed prior to graduation, actuarial internships held during their time in the program, and their employment or education plans after graduation.

*Prerequisite:* students will either have completed all course requirements for an MA in Actuarial Science or will complete all requirements by the end of the current semester.

**699 Seminar in Mathematics.** (1-6) For students who wish to pursue some particular problem or group of problems in mathematics. Assigned readings and conferences.

A total of 6 hours of credit may be earned.

# **CENTER FOR MEDICAL EDUCATION**

<u>www.bsu.edu/mcme</u> Maria Bingham Hall 201, 765-751-5100

# ANATOMY (ANAT)

**601 Human Gross Anatomy. (8)** A strong background in basic morphologic and functional relations. Emphasizes regional anatomy. Four two-and-one-half hour laboratory periods weekly.

Prerequisite: admission to the medical education program.

**606 Medical Neuroanatomy. (4)** Normal structural and functional organization of the human central nervous system as a background for the interpretation of its dysfunction. Assumes prior knowledge of human peripheral nervous system and effector mechanisms. Two-and-one-half hour lecture plus four hours of laboratory weekly.

Prerequisite: ANAT 601.

**631 Medical Histology-Embryology. (5)** Normal and abnormal developmental processes related to the differentiation of tissues and organs; microscopic study of organs and tissues as background for physiological and pathological consideration.

Prerequisite: admission to the medical education program.

### **BIOLOGY (BIO)**

**642 Medical Microbiology. (8)** Microbiology for medical students with consideration of bacteria, fungi, viruses, and parasites as agents in human disease and the immunological and serological aspects of the host-parasite relationship.

Open only to medical students or by permission of the department chairperson.

**653 Medical Genetics. (2)** Genetics for medical students: basic genetic principles, human cytogenetics, molecular genetics, genetic epidemiology, probability, population and quantitative (multifactorial) genetics, dermatoglyphics, etiology of birth defects, inborn metabolic disorders, genetic screening and counseling, genetics of mental illness and cancer, pharmacogenetics, immunogenetics, and genetic engineering.

Prerequisite: open only to medical students or by permission of the department chairperson.

## **CHEMISTRY (CHEM)**

**667 Medical Biochemistry. (6)** Chemistry of major cellular constituents; enzymes as the catalysts of intracellular chemical reactions with emphasis on underlying principles of physical and organic chemistry. Intermediary metabolism of carbohydrates, lipids, amino acids, and nucleotides; modern techniques employed in the study of metabolic processes; biosynthesis and degradation of intracellular components; hormonal regulation of metabolism.

Prerequisite: admission to the medical education program.

# PHYSIOLOGY (PHYSL)

**640 Medical Physiology. (8)** Summary of human physiology for medical students. Cellular and organsystem physiology; physiological regulation. Laboratory exercises will demonstrate general principles of physiology and introduce basic techniques and instrumentation.

Prerequisite: admission to the medical education program.

**645 Emergency Medicine.** (2) Designed to develop an awareness of proper diagnosis and treatment during emergency medical care by professional medical personnel. Fractures; environmental emergencies; injuries to the eye, chest, abdomen; shock; and wound care.

*Prerequisite:* admission to the medical education program.

# MODERN LANGUAGES AND CLASSICS

<u>www.bsu.edu/languages</u> North Quadrangle 138, 765-285-1361

**CLASSICAL CULTURE (CC)** 

**598 Reading Course. (3-9)** An arranged course in selected readings. *Prerequisite:* permission of the department chairperson. A total of 9 hours of credit may be earned.

# FOREIGN LANGUAGES (FL)

590 Independent Study. (1-9) Topics to be

chosen and investigated in consultation with a specific instructor. A total of 9 hours of credit may be earned.

**595 Methods and Materials for Teaching Foreign Language.** (3) Current methods in foreign language teaching in the senior high school. Presentation, texts, teaching materials, CAI, and other supplementary aids. Reviews current professional literature, trends, and requirements.

*Prerequisite:* two years of college credit or the equivalent in a modern language and intention to pursue a teaching curriculum.

Prerequisite recommended: EDSEC 380.

**596 Technology and Assessment in Foreign Language. (3)** Current theory and practice of technology and assessment in the foreign language classroom. Evaluation of resources, preparation of instructional materials and instruments, articulation and integration of technology and assessment into curricula and lesson plans. Audio, video, and computer-based technologies. Assessment of oral, aural, writing, reading, and culture.

*Prerequisite recommended:* FL 595. *Open only to* education majors or minors.

**599 Research Seminar.** (3) Introduction to research in foreign languages and literature. Survey, discussion, evaluation, and application of research techniques in literary study, methodology, bibliography, and practical criticism.

# FRENCH (FR)

**500 French Study Abroad. (3-9)** Study of advanced French language, literature, and culture in a country where French is the native language. May include seminars arranged during travel.

A total of 9 hours of credit may be earned.

**501 Advanced Conversation.** (**3-6**) Advanced practice in oral French to increase fluency and authenticity through discussion and debate.

A total of 6 hours of credit may be earned in combination with FR 301.

**502 Composition and Stylistics. (3-6)** Advanced practice in original composition with emphasis on style and stylistics.

A total of 6 hours of credit may be earned in combination with FR 302 or 303.

**503 Advanced Grammar. (3)** Advanced, in-depth study of French grammar with work in French-English translation.

**534 Contemporary France.** (3) Present-day France and French institutions viewed in the context of French perceptions of the family, education, politics, the judicial system, the economy, and religion. Supplementary readings in current newspapers and periodicals.

Prerequisite: FR 201, 202.

Not open to students who have credit in FR 404.

**538 Business French. (3)** Designed to make the advanced French student familiar with commercial forms and terminology used in business, banking, and industry.

Not open to students who have credit in FR 338.

**550 Workshop in Contemporary Francophone Issues. (3-6)** For inservice teachers who want to increase their proficiency in speaking and hearing the French language and their understanding of issues in present-day France and French-speaking countries.

Prerequisite: at least one year's teaching experience.

A total of 6 hours of credit may be earned.

**598 Readings. (3-9)** Individualized reading or research to allow students to explore special topics with a specific instructor. Designed to meet the needs of graduate students who have special projects in French. A total of 9 hours of credit may be earned.

**599 Bibliography and Readings. (3)** Major works, primary and secondary sources in French language, literature, culture, and teaching.

Prerequisite: 15 hours of graduate credit in French and permission of the department chairperson.

### GERMAN (GER)

**500 German Study Abroad. (3-9)** Study of advanced German language, literature, and culture in a country where German is spoken as a native language. May include seminars arranged during travel.

A total of 9 hours of credit may be earned.

**501 Advanced Conversation. (3-6)** Advanced practice in oral German to increase fluency and authenticity in the language.

A total of 6 hours of credit may be earned.

**502** Composition and Stylistics. (3-6) Advanced practice in written German with emphasis on style and stylistics.

A total of 6 hours of credit may be earned.

**550 Workshop in Contemporary German Issues.** (3-6) For inservice teachers who want to increase their proficiency in speaking and hearing the German language and their understanding of issues in present-day Germany and German-speaking countries.

Prerequisite: at least one year of teaching experience.

A total of 6 hours of credit may be earned.

**598 Readings. (3-9)** Individualized reading or research to allow students to explore special topics with a specific instructor. Designed to meet the needs of graduate students who have special projects in German.

A total of 9 hours of credit may be earned.

### **GREEK (GRK)**

**598 Readings.** (1-9) Individualized readings or research to allow students to explore special topics with an individual instructor. Designed to meet the needs of graduate students who have special projects in Greek.

Prerequisite: permission of the instructor.

A total of 9 hours of credit may be earned.

# **JAPANESE (JAPAN)**

**598 Readings.** (1-9) Individualized readings or research to allow students to explore special topics with an individual instructor. Designed to meet the needs of graduate students who have special projects in Japanese.

Prerequisite: permission of the instructor.

A total of 9 hours of credit may be earned.

# LATIN (LAT)

501 Didactic Poetry. (3) Selected readings from Lucretius, Vergil's Georgics, or Ovid's Ars Amatoria.

**502** Advanced Prose Composition. (3-6) A detailed grammar review, analysis of Latin prose style, composition of extended passages in Latin.

A total of 6 hours of credit may be earned.

507 Cicero. (3) Selected readings from Cicero's rhetorical and philosophical works.

508 Republican Historiography. (3) Selected readings from Caesar, Sallust, Nepos.

**509 Imperial Historiography. (3)** Selected readings from Livy, Tacitus, Suetonius.

**510 Roman Drama.** (3) Selected readings from Plautus, Terence, or Seneca.

**512 Lyric Poetry. (3)** Selected readings from Catullus or Horace's odes and epodes.

- **513 Elegiac Poetry. (3)** Selected readings from the elegiac poems of Tibullus, Propertius, and Ovid. *Not open to* students who have credit in LAT 304.
- 514 Vergil: Aeneid. (3) Selected readings.
- 515 Satire. (3) Selected readings from Horace, Persius, Martial, Juvenal.
- **516 Silver Latin Epic. (3)** Selected readings from Ovid's *Metamorphoses*, Lucan, or Statius. *Not open to* students who have credit in LAT 301.

**522 Silver Latin Prose. (3-6)** Selected readings from Petronius, Seneca the Younger, Quintilian, Pliny the Younger, Apuleius.

A total of 6 hours of credit may be earned.

**525 Workshop for Teachers. (3)** For inservice teachers wishing to improve their personal proficiency and update teaching methods and techniques.

Prerequisite: at least one year of teaching experience.

**598 Readings. (3-9)** Individualized readings or research allows students to explore special topics with a specific instructor.

A total of 9 hours of credit may be earned.

SPANISH (SP)

**500 Spanish Study Abroad. (3-9)** Study of advanced Spanish language, literature, and culture in a country where Spanish is the native language. May include seminars arranged during travel.

A total of 9 hours of credit may be earned.

**501 Advanced Conversation. (3-6)** Advanced practice in oral Spanish to increase fluency and authenticity through activities, discussion, and debate.

A total of 6 hours of credit may be earned.

**502 Composition and Stylistics. (3-6)** Advanced practice in original composition with emphasis on style and stylistics.

A total of 6 hours of credit may be earned.

**503 Advanced Grammar. (3)** Advanced, in-depth study of Spanish grammar with emphasis on analysis and creative expression in the language.

**511 Spanish Literature from the Seventeenth through the Nineteenth Century. (3)** The history of Spanish literature from the latter part of the Golden Age through late Romanticism. Representative works and authors.

**512 Latin American Literature through the Nineteenth Century. (3)** Major works of Spanish American literature from the chronicles to modernism.

**519 Twentieth-Century Spanish Literature. (3)** Acquaints students with the major literary works (in all genres) reflecting changing currents in Spanish life and thought during this century. Readings will include works of the Generation of '98, the Generation of '27, and post-Civil War works.

**534 Contemporary Spain. (3)** Present-day Spain and Spanish institutions viewed in the light of Spanish perceptions. Topics vary according to changing conditions and problems. *Not open to* students who have credit in SP 334.

Noi open to students who have credit in Sr 354.

**535 Contemporary Latin America. (3)** Elements of present-day problems and conditions in various countries or areas of Latin America. Topics vary according to changing conditions and problems. *Not open to* students who have credit in SP 335.

**537 Special Language Skills. (3-9)** Topics vary and will be announced. Topics may be, among others, advanced study in phonetics, composition, linguistics, Spanish-English translation, or Spanish for the professions.

A total of 9 hours of credit may be earned.

Not open to students who have credit in SP 337.

**538 Business Spanish. (3)** Designed to make advanced Spanish students familiar with commercial forms and terminology used in business, banking, and industry.

Not open to students who have credit in SP 338.

**548 Twentieth-Century Latin American Literature.** (3) Main trends in Spanish American literature (in all genres) since modernism. Includes modernism, realism, post-modernism, and recent literary trends.

**550 Workshop on Contemporary Issues. (3-6)** For inservice teachers wishing to improve their proficiency in contemporary Spanish usage.

Prerequisite: at least one year's teaching experience.

A total of 6 hours of credit may be earned.

**598 Readings. (3-9)** Individualized reading or research to allow students to explore special topics with a specific instructor. Designed to meet the needs of graduate students who have special projects in Spanish.

A total of 9 hours of credit may be earned.

**599 Bibliography and Readings. (3)** Major works, primary and secondary sources in Hispanic language, literature, culture, and teaching.

Prerequisite: 15 hours of graduate credit in Spanish.

# NATURAL RESOURCES AND ENVIRONMENTAL MANAGEMENT

<u>www.bsu.edu/nrem</u> West Quadrangle 110, 765-285-5780

# PROGRAMS

Master of arts (MA) in natural resources and environmental management and master of science (MS) in natural resources and environmental management.

See the Science listing under the College of Sciences and Humanities, page 180, for the doctoral programs in science education and philosophy in environmental science. Specializations within the program include: environmental management, environmental education and communication, international resource management, land management, occupational and industrial hygiene, park and recreation management, and sustainable development.

### **Admission requirements**

Applicants must meet the admission requirements of the Graduate School, take the Graduate Record Examination (GRE), complete the departmental application form, and provide letters of recommendation. Applicants whose undergraduate majors are not natural resources or closely related subjects may be required to complete undergraduate courses to acquire background knowledge. Credit for these courses does not apply to graduate degree requirements.

# MASTER OF ARTS IN NATURAL RESOURCES AND ENVIRONMENTAL MANAGEMENT

# **Degree requirements**

PREFIX NO SHORT TITLE CR HRS

Required	l cours	es	
NREM	608	Resch Method	3
	609	Seminar	3
RES	697	Research Ppr (1-3)	3
Electives	s inclue	de other NREM	
courses a	and rel	evant courses	
from oth	er depa	artments to be	
approved	l by th	e graduate advisor	24
		-	

# MASTER OF SCIENCE IN NATURAL RESOURCES AND ENVIRONMENTAL MANAGEMENT

#### **Degree requirements**

PREFIX NO SHORT TITLE CR HRS **Required Courses** NREM 608 Resch Method 3 609 Seminar 3 THES 698 Thesis (1-6) 6 Electives include other NREM courses and relevant courses from other departments to be approved by the graduate advisor 21

33 hrs

## **Facilities and Special Programs**

Facilities consist of teaching and research laboratories, lecture and discussion class-rooms, a computer lab, a darkroom, a student reading room, and a seminar-conference room. All classrooms and laboratories are accessible to students with disabilities.

University-owned properties—the Hults Environmental Learning Center, Christy Woods, Ball State Wildlife Preserve, and Ginn-Nixon Woods—near the Ball State campus serve as field laboratories for teaching and research. The city of Muncie and surrounding areas offer first-hand study of environmental issues such as air, water, and soil quality, energy issues, land-use planning, and recreational management.

Research equipment includes state-of-the-art instrumentation for analysis of a variety of contaminants of air, water, and land.

Each summer the department sponsors field courses in which students travel to diverse locations for study. Past field courses have studied resource management in the American West, the Great Lakes states, the Appalachians, Central America, and Europe.

In addition to off-campus field courses, the department offers practicum opportunities with federal, state, and private agencies in various facets of resource management.

# CERTIFICATE IN EMERGENCY MANAGEMENT AND HOMELAND SECURITY

PREFIX NO SHORT TITLE CR HRS

EMHS	552	Sci WMD Tech	3
	589	WMD Aware	3
	550	Haz Mat Safe (3)	
	or		
	669	Pro Practice (1-3)	3

6 hours from

CS547Net Security (3)EMHS593Spec Topics (1-6)GEOG534Atmos Hazard (3)

	544	Adv GIS Anly (3)	
GEOL	516	Geol Haz Env (3)	
ISOM	601	Intro CP Sec (3)	
POLS	545	Nat Def Poly (3)	
	694	Terr Hom Sec (3)	
PR	660	PR Theories (3)	6

15 hrs

#### NATURAL RESOURCES AND ENVIRONMENTAL MANAGEMENT (NREM)

**502 Field Study.** (1-6) Off-campus field studies of a specific geographic area with emphasis on resource management. Details of arrangements (including group travel plans and housing) will be provided by the instructor.

Prerequisite: permission of the department chairperson.

A total of 6 hours of credit may be earned.

**504 Sustainable Agriculture.** (3) Natural resource use in agricultural systems with emphasis on principles of sustainability. Includes integrated pest management, permaculture, and other production practices that conserve soil, water, and biological resources. Field trips included.

Not open to students who have credit in NREM 304.

**505 Integrated Resource Management. (3)** Systems perspective on holistic or integrated planning and management of natural resources. Stresses data analysis and its role in the decision-making process.

*Prerequisite:* permission of the department chairperson. *Not open to* students who have credit in NREM 405.

**507 Environmental Management in Developing Countries.** (3) Survey of challenges facing management of urban environments and the rural-urban interface in the developing nations of Asia, Africa, Latin America, and Pacific Oceania. Features interdisciplinary approach with frequent guest speakers to discuss existing and potential management, economic, technical, and policy solutions in their regional, cultural, and historical contexts.

Not open to students who have credit in NREM 307.

**509 Human Dimensions of Global Change.** (3) Systematic exploration of major topics of human and environmental change from local to global scales, including population, energy, agriculture, industry, technology, urbanization, water, climate, natural hazards, socioeconomic systems, land use, trade, marginalized societies, and biodiversity.

Not open to students who have credit in NREM 309.

**511 Water Resources. (3)** Hydrologic cycle and climate as a basis for water resources distribution and management. U.S. and international water resources issues: U.S. water allocation laws, national and international water conflicts, water quality, drinking water and wastewater treatment, surface and ground water hydrology, municipal water resources development. Includes laboratory and field work and a graduate-level research project.

**515 Water Quality Management. (3)** Effects, consequences of point and non-point sources of pollution on quality of surface and drinking water; occurrence, sources and effects of regulated and unregulated contaminants; role of regulations in water quality management in U.S., centralized drinking water and wastewater treatment. Laboratory analysis of water quality parameters; may include field work.

Prerequisite: NREM 511 or permission of the department chairperson.

**520 Wetland Characterization.** (3) Study of wetland functions and values. Delineation of wetland boundaries according to the U.S. Army Corps of Engineers criteria (wetland hydrology, hydric soils, hydrophytic vegetation). Includes a substantial component of field work.

Prerequisite: permission of the department chairperson.

**521 Soil Resources.** (3) The basic properties of the soil portion of the ecosystem. Prime emphasis on the genesis and resulting chemical and physical characteristics of soils. Includes a graduate-level research project.

Prerequisite: CHEM 112, or the equivalent; or permission of the department chairperson.

**522 Soil Quality. (3)** Chemical, physical, and biological properties of soil that affect plant production and other land uses. Emphasizes nutrient cycles in natural and cropped systems. Use and fate of pesticides. Land application of agricultural and urban wastes.

*Prerequisite:* CHEM 111 or equivalent; or permission of the department chairperson. *Not open to* students who have credit in NREM 322.

**524 Soil Classification and Interpretation.** (3) Soil genesis, morphology, classification, and survey. The relationship between soils information and land use; practical application in the decision-making process. Emphasizes field study of soils and their uses.

Not open to students who have credit in NREM 324.

**527 Soil Conservation and Management. (3)** Principles and methods of controlling soil erosion, stressing use of basic soil concepts. Management systems and individual practices, with special emphasis on soil resource maintenance.

Not open to students who have credit in NREM 327.

**531 Energy and Mineral Resources: Issues and Choices. (3)** Appraisal of the problems, prospects, and societal and technical issues surrounding the use of energy and mineral resources. Emphasizes environmental problems and ecoenergetics, consideration of the natural resource base, distribution and production problems, conservation, alter-native energy systems, resource policy, and research.

Not open to students who have credit in NREM 331.

**535 Renewable Energy and Sustainable Technology. (3)** Exploration of alternative/ renewable energy systems (wind, solar, hydro, biomass, geothermal, fuel cells). Case studies of sustainable technology emphasize topics including industrial ecology (life-cycle analysis, design for the environment, clean manufacturing, and impact assessment) and appropriate technology applications in developing countries. Problem-solving applications using various approaches.

Not open to students who have credit in NREM 335.

**541 Air Quality. (3)** Focuses on the contamination of the atmospheric environment. Topics include major contaminants; measurement techniques; dispersion; effects on the atmosphere, human health, vegetation, and materials; regulatory requirements and practices; control measures; noise pollution. Lab and field experiences.

Not open to students who have credit in NREM 241.

**546 Indoor Environmental Quality. (3)** Focuses on problems in residential and nonresidential indoor environments; contaminants; health effects; sick buildings; diagnosis and measurement; mitigation measures. Lab and field experiences.

Not open to students who have credit in NREM 346.

**547 Occupational/Industrial Hygiene.** (3) Introduces the principles of assessing and controlling exposures to workplace hazards. Topics include occupational disease; exposure to contaminant gases, dusts, radiation, noise, and biological agents; ergonomic concerns; regulatory requirements; engineering control and personal protection equipment.

Not open to students who have credit in NREM 347.

**548** Asbestos and Lead Management. (3) Principles and practices associated with conducting asbestos and lead inspections and exposure hazard assessments. Discussion of use, health effects, assessment methods, and regulatory requirements. State certifications available on successful completion. Field and hands-on experiences.

Not open to students who have credit in NREM 348.

**553 Turfgrass Management. (3)** Maintenance of turfgrass lawns, golf courses, athletic fields, playgrounds, parks, and roadsides. Practical management recommendations including regional adaptation of grasses, soils, fertilization, general maintenance practices, diseases, and insect control. Stresses the identification of grass and weed species.

**557 International Community Development. (3)** Application of practical methods to problems of development in poor rural agrarian communities and environmental management in poor urban communities in Asia, Africa, and Latin America. Emphasizes face-to-face methodologies to the identification and development of workable solutions to resource and environmental problems of disadvantaged populations in developing nations.

Not open to students who have credit in NREM 357.

**571 Outdoor Recreation and Society. (3)** The role of outdoor recreation in modern society. Perspectives ranging from local to global. Examination of the history of growth in outdoor recreation in the United States to the present day, emphasizing issues in both public and private sectors. May require one weekend field trip in addition to regular laboratory periods.

Not open to students who have credit in NREM 371.

**572 Applied Research Methods in Resource Management.** (3) Designed to train students in social science applications in natural resource and environmental management. These applications include quantitative and qualitative survey research designs, analysis of social data, and applications of survey results to political processes. Perspectives range from local to international.

Not open to students who have credit in NREM 372.

**573 Outdoor Recreation Planning and Administration. (3)** Application of basic principles and procedures for the planning and administration of resource-based and activity-based recreation areas. May require one weekend field trip as well as in-class field trips.

*Prerequisite:* NREM 371 or 571 or permission of the department chairperson. *Not open to* students who have credit in NREM 473.

**577 Wilderness and Society. (3)** Defining wilderness, understanding its unique significance, and analyzing techniques of past and present management. Includes study of research in perception and use. Weekend trip to the Deam Wilderness—Hoosier National Forest or a state forest back-country area.

Not open to students who have credit in NREM 477.

**581 Site Remediation Technologies. (3)** Engineering principles applied to selected environmental problems. Underground storage tank closure and removal; environmental site assessments; remediation of severely disturbed environments; site safety issues. Some environmental chemistry.

Prerequisite: NREM 221 or 521; CHEM 111, 112; or permission of the department chairperson.

Not open to students who have credit in NREM 481.

**585 Wastewater Management. (3)** Effects of wastewater on receiving waters, need for wastewater treatment, principles of wastewater treatment technologies: onsite, centralized, conventional and alternative treatment technologies; management and regulatory strategies. Includes field trip(s).

Not open to students who have credit in NREM 385.

**586** Computer Applications in Environmental Management. (3) Use of computer software applications for data analysis and management of natural and human-controlled environments. Work with word processors, spreadsheets, statistical analysis packages, presentation graphics, Web browsers/editors, and computer simulation models. Requires basic understanding of computer operation.

Prerequisite: permission of the department chairperson.

Not open to students who have credit in NREM 286.

Open only to NREM majors.

**587 Solid and Hazardous Waste Management. (3)** Delineation of solid and hazardous waste management in the United States. Waste reduction, recycling, processing, and disposal methods are discussed. Technical, political, and economic aspects of waste management. Effects of improper disposal on environmental quality.

Not open to students who have credit in NREM 387.

**588 Site Assessment and Remediation. (3)** Experience with Phase I and Phase II environmental site assessments. Conventional and innovative technologies for remediation of contaminated soils and groundwater. Review of relevant environmental regulations. Some environmental chemistry.

Prerequisite: CHEM 231 or permission of the instructor.

**592 Environmental Interpretation. (3)** Develops skills and techniques necessary to the interpretation of ecological and environmental characteristics of earth systems. Emphasizes field work and creative presentation of concepts, and organization and management of interpretive programs including sites and facilities.

Not open to students who have credit in NREM 392.

**595 Teaching Environmental Education. (3)** Opportunities for enriching instruction through environmental education in formal and nonformal educational settings. Studies conservation, outdoor and environmental education, including teaching techniques and instructional resources used in each.

Not open to students who have credit in NREM 395.

**597** Special Studies in Environmental and Natural Resource Sciences. (1-3) Special academic study opportunities in the environmental and natural resource sciences.

Prerequisite: permission of the department chairperson.

A total of 6 hours of credit may be earned, but no more than 3 in any one semester or term.

**608 Research Methodologies in Natural Resources and Environmental Sciences. (3)** Development of concepts and skills for those preparing for graduate research in natural resources and environmental sciences. Introduction to research designs, data-gathering techniques, data analysis, and research planning. Emphasizes interpreting published research and the drafting of a concise research proposal.

**609 Seminar.** (3) Presentations of graduate student research or program projects. Discussion and critical examination of resource/environmental topics. Assessment of scientific inquiry by data analysis and interpretation.

Prerequisite: NREM 608 or permission of the department chairperson.

669 Advanced Professional Practice. (1-3) Advanced supervised professional learning experiences in environmental/natural resource management, studies, or education.

Prerequisite: permission of the department chairperson.

A total of 3 hours of credit may be earned.

### 697 Advanced Topics in Environmental and Natural Resource Management.

(1-3) Advanced special topics course in environmental and natural resources management.

Prerequisite: permission of the department chairperson.

A total of 6 hours of credit may be earned, but no more than 3 in any one semester or term.

# **EMERGENCY MANAGEMENT AND HOMELAND SECURITY (EMHS)**

550 (NREM 550) Hazardous Materials Health and Safety. (3) Worker health and safety principles and practices in: handling hazardous materials, waste remediation, and emergency responses to accidental chemical releases and terrorist episodes.

Not open to students who have credit in EMHS 350.

551 Introduction to Emergency Management and Homeland Security. (3) Introduction to principles of emergency management and homeland security such as preparedness, response, recovery, and mitigation. Other concepts include hazards, communications, management, health issues, and tools utilized in emergency management. Discussion of relevant issues from a multi-disciplinary approach.

Not open to students who have credit in EMHS 351.

552 Science of WMDs and Technological Hazards. (3) Application of scientific principles to technological hazards including biological, chemical, radiological, nuclear and explosive weapons (weapons of mass destruction). Discussion of relevant principles in biology, chemistry, physics, and other sciences. Effects of hazards on air, water, food supplies, and human health.

589 (NREM 589) WMD Awareness and Response. (3) Awareness of toxicological effects and treatment of biological, chemical, radiological, nuclear, and explosive agents (WMDs). Emergency response to domestic incidents. The Incident Command System. Selection and proper use of chemicallyprotective clothing. Decontamination principles.

**593 Special Topics.** (1-6) Provides an opportunity to conduct independent study of emergency management and homeland security topics of special interest to students.

Prerequisite: permission of the department chairperson.

A total of 6 hours of credit may be earned.

**669** Professional Practice. (1-3) Supervised experience in emergency planning and management, science of hazards, and/or cyber security. Connects academic with professional experiences.

A total of 3 hours of credit may be earned.