

Department of Biology

George Murphy, Chair
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The Department of Biology offers preparation for teachers of biology, for biologists in industrial and governmental employment, and for students planning for graduate study in biology or for advanced professional courses in health sciences. The program for the Biology major leads to the Bachelor of Science degree. Students choose from concentrations in Animal Biology, General Biology, Genetics and Biotechnology, Microbiology, Physiology, and Plant Biology. A minor in Secondary Education is suggested for those persons planning to teach. A minor in Biology is also available.

Environmental Science and Technology is an interdisciplinary major and minor offered by Agribusiness and Agriscience, Biology, Chemistry, and Engineering Technology and Industrial Studies. A complete description of the program is found under the Department of Engineering Technology and Industrial Studies.

Curricular listings include General Education requirements in Communication, History, Humanities and/or Fine Arts, Mathematics, Natural Sciences, and Social/Behavioral Sciences categories as outlined on pages 64–67.

Major in Biology

The major in Biology requires 40 semester hours including a biology core for all concentrations of 26 semester hours:

1. BIOL 1110 and 1120 or, with approval of the department head, BIOL 1030 with a grade of A or B plus 4 hours from upper-division courses;
2. BIOL 2120, 2230, 3230, 4240;
3. BIOL 4110 or 4210 or 4500.

Other requirements include

1. MATH 1910 and one of the following: BIOL 4350 or MATH 2050 or MATH 1920;
2. 12 hours of chemistry (1110, 1120, and 2030 or 3010).

All Biology majors are assigned a faculty advisor through the Biology Department Office (DSB 128). The student is responsible for seeking the assistance of the advisor. This catalog is not intended to provide the detail necessary for self-advising.

Every Biology major is required to declare a concentration area. Each area requires semester hours to be selected from a set of designated courses.

Concentration: Animal Biology

Minimum of 10 hours selected from
BIOL 3010, 3020, 3040, 3050, 4130, 4140, 4180, 4220, 4390, 4580, 4720

Concentration: General Biology

Select one course from each of the following three areas:

1. BIOL 3010 or 3020 or 4180;
2. BIOL 3030 or 4080 or 4120;
3. BIOL 3040 or 3050 or 4130 or 4140.

Concentration: Genetics and Biotechnology

BIOL 4550 and BIOL 4450 or 4460 and one course selected from
BIOL 4270, 4290, 4300, 4450, 4460, 4510, 4570, 4720

Concentration: Microbiology

Minimum of 10 hours selected from
BIOL 3050, 3210, 4080, 4300, 4430, 4440, 4450, 4510, 4550, 4730

Concentration: Physiology

Minimum of 10 hours selected from
BIOL 3010, 3020, 4110*, 4130, 4170, 4210*, 4300, 4440, 4500*, 4520, 4560, 4570

**only if not used for core requirement*

Concentration: Plant Biology

Minimum of 10 hours selected from
BIOL 3030, 4060, 4080, 4120, 4520

Suggested freshman and sophomore program for majors not planning to teach

FRESHMAN		SOPHOMORE	
BIOL 1110 (Nat Sci)	4	BIOL 2120, 2230	8
BIOL 1120	4	ENGL 2020 or 2030 or	
CHEM 1110 (Nat Sci)	4	HUM 2610 (Hum/FA)	3
CHEM 1120	4	HIST 2010, 2020, or 2030	6
ENGL 1010, 1020 (Comm)	6	CHEM 2030 or 3010	4
MATH 1910 (Math)	4	Social/Behavioral Sciences	3
COMM 2200 (Comm)	3	BIOL 4350 or MATH 2050*	3-4
	29	*Elective (if MATH 2050 taken)	1
		Minor	3
			31

JUNIOR

Social/Behavioral Sciences	3	SENIOR	
Humanities and/or Fine Arts	3	Humanities and/or Fine Arts	3
BIOL 3230	2	BIOL concentration	6
BIOL 4240	4	Minor**	9
BIOL 4110, 4210, or 4500	4	Upper-division BIOL elective	4
BIOL concentration	4	Electives**	9
Minor**	6		31
Elective**	3		
	29		

**See advisor for additional choices in this area.*

***Must include 16 hours of upper-division classes.*

Teacher Licensure

Students seeking a license to teach in secondary schools (grades 7-12) must complete (1) a major in the subject they intend to teach, (2) a minor in Secondary Education, and (3) additional teacher licensure requirements.

Additional Teacher Licensure Requirements

See Biology Department for course requirements in addition to the General Education requirements.

Secondary Education Minor Requirements

Students must contact their Secondary Education minor advisors for approval of appropriate courses.

NOTE: Please see Department of Educational Leadership on page 201 for Secondary Education minor requirements.

Biology Major Requirements for Licensure

Complete the following General Biology concentration:

BIOL 1110, 1120, 8 hours

BIOL 2120, 4 hours

BIOL 2230, 4 hours

BIOL 3230, 2 hours

BIOL 4240, 4 hours

Select one: BIOL 3010, 4 hours; BIOL 3020, 4 hours; BIOL 4180, 4 hours

Select one: BIOL 3030, 4 hours; BIOL 4080, 4 hours; BIOL 4120, 4 hours; BIOL 4520, 4 hours

Select one: BIOL 3040, 3 hours; BIOL 3050, 3 hours; BIOL 4130, 4 hours; BIOL 4140, 4 hours

Select one: BIOL 4110, 4 hours; BIOL 4210, 4 hours; BIOL 4500, 4 hours

Biology electives to total 40 hours minimum.

Minor in Biology

There are two options for the minor in Biology:

1. 19 semester hours in biology including one year of freshman biology or equivalent and BIOL 2120 and 2230.
2. 19 semester hours in biology including BIOL 1030 with a grade of A or B and 4 hours chosen from upper-division courses and approved by the department head and BIOL 2120 and 2230.

Each option requires at least one upper-division course to be taken at MTSU. A 2.00 GPA is required for courses satisfying the minor in Biology.

Four or more semester hours of freshman-level General Education equivalent biology in transfer credits may be substituted for BIOL 1030.

Course in General Education Biology [BIOL]

1030 Topics in Biology. Four credits. Designed for non-majors. Offers understanding, experiences, and skills related to common biological issues. Includes class discussions, small group activities, lectures, selected readings, and laboratory investigations. Three lectures and one two-hour laboratory.

Courses in Biology [BIOL]

1110 General Biology. Four credits. Primarily for Biology majors and minors and other science-oriented students. Biological principles and processes, including introduction to the nature of science, cells (structure, function, metabolism, division), genetics, evolution, viruses, bacteria, protists, and fungi. Three lectures and one three-hour laboratory. **While BIOL 1110 can be used to fulfill half the 8-hour General Education requirement for Natural Sciences, it is the first semester of a two-semester sequence primarily designed for science majors.**

1120 General Biology. Four credits. Prerequisite: BIOL 1110. Primarily for Biology majors and minors and other science-oriented students. Survey of plants and animals emphasizing evolution, structure, function, reproduction, growth, and ecology. Three lectures and one three-hour laboratory.

2000 Orientation to the Medical Lab. Two credits. Open to anyone in medical and allied medical careers, but may not be taken as part of Biology major. Survey of medical lab careers, curricula, and affiliated laboratory programs; experience in medical laboratory testing procedures. One lecture and one two-hour laboratory.

2010, 2020 Human Anatomy and Physiology I and II. Four credits each. Prerequisites: BIOL 2010 - C or better in high school chemistry and biology within the last five years or consent of instructor; BIOL 2020 - C or better in 2010. Strongly recommend BIOL 1030/1110 prior to BIOL 2010. Meets requirements for many pre-health professional programs including nursing. Structure and function of humans covered. Three lectures and one three-hour laboratory.

2030 Anatomy and Physiology. Three credits. Prerequisite: BIOL 1030 or 1110. General structure and physiological activities of human systems. Two lectures and one two-hour laboratory.

2120 Genetics. Four credits. Prerequisites: BIOL 1110, 1120. An introductory course in genetics. Surveys and explores the sub-disciplines of genetics, including classical, molecular, and evolutionary genetics. Emphasis on the experiments, techniques, and theories forming the foundation of modern genetic research and its applications. Three lectures and one two-hour laboratory.

2230 Microbiology. Four credits. Prerequisites: BIOL 1110, 1120 or 2010, 2020; background in general chemistry strongly recommended. Morphology, physiology, isolation, and cultivation of bacteria, fungi, and viruses. Three lectures and one two-hour laboratory.

3000 Life Science for Elementary Teachers. Four credits. Prerequisites: 8 hours of science including BIOL 1030 or equivalent. A process-oriented approach to the study of life with emphasis on execution and analysis of activities and experiments suited to the elementary school classroom. Six hours lecture and laboratory. (May not be used for Biology majors or minors.)

3010 Embryology. Four credits. Prerequisites: BIOL 1110, 1120. Early development of the frog, chick, pig, and human. Living material, whole mounts, and serial sections are used for studying cleavage, germ layer formation, histogenesis, and organogenesis. Three lectures and one three-hour laboratory.

3020 Comparative Anatomy of the Vertebrates. Four credits. Prerequisites: BIOL 1110, 1120. Vertebrate morphology and the development and function of systems and organs. Three lectures and one three-hour laboratory.

- 3030 Non-Flowering Plants.** Four credits. Prerequisites: BIOL 1110, 1120. Structure, physiology, methods of reproduction, and classification of the algae, fungi, liverworts, mosses, and ferns. Three lectures and one three-hour laboratory.
- 3040 Entomology.** Three credits. Prerequisites: BIOL 1110, 1120. Morphology, classification, evolution, life histories, and economic importance of insects. Five hours of lecture and laboratory.
- 3050 Parasitology.** Three credits. Prerequisites: BIOL 1110, 1120. Life histories, host-parasite relationships, and control measures of the more common parasites of humans and domesticated animals. Two lectures and one three-hour laboratory.
- 3070 Biology Seminar on Environmental Problems.** Three credits. Causes, effects, and solutions of environmental problems. Three lectures.
- 3100 History and Philosophy of Biology.** Three credits. Prerequisites: BIOL 1110, 1120. Historical development of biology; the philosophy, ideas, and contributions of outstanding biologists. Two lectures.
- 3160 Social Issues and Genetic Technology.** Three credits. Prerequisite: BIOL 1030 or 1110 or 1120. Exploration of genetic principles related to contemporary issues. Provides students with the background needed to evaluate topics such as the release of genetically engineered plants and animals, the use of DNA fingerprinting techniques, the relationship between race and IQ, and others which impact their lives. Impact of genetics on society as well as society's influence on the science will be explored. Role of genetics in medicine and agriculture also emphasized.
- 3200 Internship in Biology.** Two to four credits. Prerequisite: Permission of department. Practical experience for students in a professional setting.
- 3210 Environmental Microbiology.** Three credits. Prerequisite: BIOL 2230. Deals with microorganisms commonly found in air, water, and soil. Two lectures and one three-hour laboratory.
- 3220 Environmental Regulations and Compliance.** Three credits. Prerequisites: BIOL 1110, 1120. An in-depth review and application of governmentally established regulations concerning environmental quality. Emphasis on major federal acts. Three lectures.
- 3230 Introduction to Biological Literature.** Two credits. Prerequisites: BIOL 1110, 1120. Application of methods of literature research in the biological sciences and techniques of scientific writing.
- 3240 Introduction to Evolution.** Three credits. Prerequisites: BIOL 1110 and 1120 or 1030. Scientific principles and concepts formulating the biological theory of evolution. Includes historical development of modern theory; Darwin's natural selection theory; and problems in speciation, systematics, and geographical distribution of species.
- 3340 Pathophysiology.** Three credits. (Same as NURS 3010.) Prerequisites: BIOL 2230, 2010, 2020. Basic mechanisms of disease processes and their role in disrupting normal physiology. Three lectures.
- 3350 Principles of Radiation in Medicine.** Three credits. Prerequisites: PHYS 2010/2011 and 2020/2021. Basic concepts and theories of radiation physics. Detailed analysis of the structure of matter, properties of radiation, nuclear transformations, x-ray production, and interactions of ionizing radiation emphasized. Treatment units used in external radiation therapy, measurement and quality of ionizing radiation produced, absorbed dose measurement, dose distribution, and scatter analysis presented.
- 4060 Dendrology.** Three credits. Prerequisite: BIOL 1120. Woody plants with emphasis on important timber trees of North America. Two lectures and one three-hour laboratory.
- 4070 Economic Botany.** Three credits. Prerequisite: BIOL 1120. Useful plants which have shaped civilization. Topics include origin of agriculture, fruits and nuts, grains and legumes, vegetables, spices and herbs, oils and waxes, medicinal plants, psychoactive plants. Three lectures.
- 4080 Mycology.** Four credits. Prerequisite: BIOL 1120. Emphasizes taxonomy, morphology, and culture of fungi and their importance to humans. Three lectures and one three-hour laboratory.
- 4110 General Physiology.** Four credits. Prerequisites: BIOL 2120; CHEM 3010 or 2030. Physiological and chemical properties of life processes in animals using an organ systems approach. Emphasis on mammalian physiology. Three lectures and one three-hour laboratory.
- 4120 Flowering Plants.** Four credits. Prerequisites: BIOL 1110, 1120. Structure and classification of seed plants; a survey of local flora. Three lectures and one three-hour laboratory.



- 4130 Histology.** Four credits. Prerequisites: BIOL 1110, 1120, 2120; CHEM 1110, 1120. Microscopic anatomy of vertebrate cells, tissues, and organs. Three lectures and one three-hour laboratory.
- 4140 Invertebrate Zoology.** Four credits. Prerequisites: BIOL 1110, 1120. Morphology, classification, evolution, life histories, and economic importance of invertebrate phyla. Three lectures and one three-hour laboratory.
- 4150 Radiation Biology.** Three credits. Prerequisites: Junior standing and permission of department. Types and properties of ionizing radiation, isotopes and tracer study techniques, and the biological effects of ionizing radiations on living things.
- 4170 Endocrinology.** Three credits. Prerequisites: BIOL 2120, 4110 or 2020; CHEM 3010 or 2030. Study of hormones and other chemical messengers including synthesis, secretion, transport, receptors, cellular, and physiological activity. Focus on humans and other vertebrates. Three lectures.
- 4180 Vertebrate Zoology.** Four credits. Prerequisites: BIOL 1110, 1120. Structure, life history, and classification of fish, amphibians, and mammals. Local representatives emphasized. Three lectures and one three-hour laboratory.
- 4210 Cell and Molecular Biology.** Four credits. Prerequisites: BIOL 1110, 1120, 2120, 2230; CHEM 2030 or 3010. Cellular morphology and function. Three lectures and one three-hour laboratory.
- 4220 Ichthyology.** Four credits. Prerequisites: BIOL 1110, 1120. The morphology, physiology, taxonomy, and ecology of fishes. Three lectures and one three-hour laboratory.
- 4240 General Ecology.** Four credits. Prerequisites: BIOL 1110, 1120; CHEM 1110. Basic concepts of the ecosystem and community aquatic and terrestrial habitats, and population ecology; complemented by field and laboratory activities. Three lectures and one three-hour laboratory.
- 4250 Limnology.** Four credits. Prerequisites: BIOL 1110, 1120; CHEM 1110. Biological, chemical, and physical aspects of lakes and streams. Three lectures and one three-hour laboratory.
- 4260 Nature Study.** Three credits. Prerequisites: BIOL 1110, 1120. Identification of local plants and animals and a consideration of the ecological principles governing them. Two lectures and one two-hour laboratory.
- 4270 Transmitting Electron Microscopy.** Four credits. Prerequisite: Permission of department. Tissue fixation, dehydration, embedding, and thin sectioning for examination and development of micrographs using a Zeiss electron microscope. One-hour lecture and three two-hour laboratory periods.
- 4280 Undergraduate Research in Biology.** Three credits. Prerequisite: Permission of department. Selection, design, and conduction of projects.
- 4290 Scanning Electron Microscopy.** Four credits. Prerequisite: Permission of department. Preparation of biological and non-biological materials for examination and development of micrographs using an ISI electron microscope. One-hour lecture and three two-hour laboratory periods.
- 4300 Immunology.** Four credits. Prerequisite: BIOL 2230. Humoral and cellular mechanisms of immunity. Two lectures and one two-hour laboratory.
- 4320 Seminar: Advancements in Biology.** Two credits. Prerequisite: Senior standing. A broad overview of biological principles and recent research developments. Two lectures.
- 4331- Biome Analysis.** One to four credits. Prerequisite: Permission of department and junior or senior standing. An intensive classroom and on-site study of a specific biome. Special emphasis on data collection and analysis. Consult the department chair for specific credits and costs.
- 4332 Cedar Glade**
- 4333 Biome Analysis**
- 4333 Desert**
- 4350 Biometry.** Four credits. Prerequisites: BIOL 1110, 1120, 2120. Statistical methods utilized in biological research. Three lectures and one two-hour laboratory.
- 4360 Energy Dispersive X-Ray Analysis.** One credit. Prerequisite: BIOL 4290. Elemental analysis of materials using an energy dispersive x-ray system with scanning electron microscopy. One three-hour laboratory.
- 4390 Ethology.** Four credits. Prerequisite: BIOL 1110. Innate and learned animal behavior in primitive and advanced animals including behavior associated with space, reproduction, and food getting. Three lectures and one three-hour laboratory.
- 4400 Medical Botany.** Three credits. Prerequisite: BIOL 1120. Plants affecting human health. Included are poisonous and psychoactive as well as remedial plants; both ethnobotanical and modern medicinal uses treated. Three lectures.
- 4430 Diagnostic Microbiology.** Four credits. Prerequisite: BIOL 2230. Microorganisms that cause disease in humans and other animals, their isolation and identification, mechanisms of disease causation, and methods of control. Two lectures and one four-hour laboratory.
- 4440 General Virology.** Four credits. Prerequisites: BIOL 2230; CHEM 1110, 1120. Viruses, with emphasis on their clinical importance and impact on biotechnology. Two lectures and one four-hour laboratory.
- 4450 Molecular Genetics.** Four credits. Prerequisites: BIOL 2230, 2120; CHEM 1110, 1120. Basic techniques of microbial genetics and gene manipulation with emphasis on the application of molecular genetics in basic and applied research. Six hours lecture/laboratory.
- 4460 Human Genetics.** Three credits. Prerequisite: BIOL 2120. Application of the fundamental laws of inheritance to humans. Two lectures and one two-hour laboratory.
- 4500 Plant Physiology.** Four credits. Prerequisites: BIOL 1110, 1120, 2120; CHEM 2030 or 3010. Plant growth, development, and metabolism at the cellular and whole plant levels. Six hours of lecture/laboratory.
- 4510 Food/Industrial Microbiology.** Four credits. Prerequisite: BIOL 2230. Interaction between microorganisms and food; industrial processes of importance to humans. Two lectures and two two-hour laboratory periods.
- 4520 Plant Anatomy.** Four credits. Prerequisite: BIOL 1120. Plant cells, tissues, and organs. Emphasis on the survival value of the plant's various structural features. Three lectures and one three-hour laboratory.

- 4540 Topics in Environmental Education.** One to four credits. Prerequisite: Junior standing or above. An intensive classroom and field study of natural science and resources in Tennessee. Special emphasis on data collection, analysis, and problem solving. Target groups are upper-division students in biology and education. Consult the department chair for specific credits and costs. THIS COURSE DOES NOT APPLY TO THE BIOLOGY MAJOR OR MINOR.
- 4550 Biotechnology.** Three credits. Prerequisites: BIOL 1110, 1120, 2230. Instruction in both theory and application of current research methodologies in biology and molecular biology. Topics include immunochemistry, polymerase chain reaction, restriction enzyme analysis, and electrophoresis. Five hours lecture/laboratory.
- 4560 Neurobiology.** Four credits. Prerequisites: BIOL 1110, 1120. Introduces comparative neurobiology. Topics include the basic structure and function of the nerve cell and organization of nervous systems of representative species of invertebrate and vertebrate animals. Two lectures and one three-hour laboratory.
- 4570 Principles of Toxicology.** Three credits. Prerequisites: BIOL 1110, 1120; CHEM 1110, 1120, 3010. Study of adverse effects of chemical agents on living organisms; current toxicological techniques used in the laboratory. Two-hour lecture and one three-hour laboratory.
- 4580 Marine Biology.** Four credits. Prerequisites: BIOL 1110, 1120; CHEM 1110, 1120. Introduction to the biological, chemical, and physical characteristics of major marine environments and their associated flora and fauna. Three lectures and one three-hour laboratory.
- 4590 Principles of Environmental Toxicology.** Four credits. Prerequisites: BIOL 1110, 1120; CHEM 1110, 1120, 3010. Ecological effects of chemicals in the environment and techniques currently utilized to assess these effects. Lab includes current environmental assessment techniques, including biomonitoring. Three-hour lecture and three-hour laboratory.
- 4700 Principles of Plant-Animal Interactions.** Three credits. Prerequisites: BIOL 1110, 1120. Evolutionary and ecological perspectives on how plants attract and repel organisms that influence their ability to survive and leave progeny. Topics include angiosperm evolution; the coevolution of plants with pollinators, herbivores, mycorrhizae, and N-fixing bacteria; how plant secondary metabolites facilitate or mitigate these interactions. Two-hour lecture and three-hour laboratory.
- 4720 Animal Development.** Four credits. Prerequisites: BIOL 1110, 1120, and 2120; BIOL 4210 recommended. Processes and underlying molecular mechanisms by which a single fertilized egg develops into an adult organism, focusing on vertebrate development, but including insights gained from other model organisms. Three hours of lecture and two hours of lab.
- 4730 Microbial Physiology and Biochemistry.** Prerequisites: General biology (BIOL 1110 and 1120), microbiology (BIOL 2230), general chemistry (CHEM 1110, 1111, 1120, and 1121), and organic chemistry (CHEM 2030 or 3010), or consent of instructor. Survey of the physiology and biochemistry of prokaryotic and eukaryotic microorganisms. Two three-hour blocks of lecture/lab.
- 4750 Plant Biotechnology.** Four credits. Prerequisites: BIOL 1110, 1120, 2120. Processes and reasoning behind the human manipulation of plant species for agricultural and technological

purposes. Topics include traditional breeding techniques, tissue culture, plant cell transformation, and general plant molecular biology techniques as well as current debate over genetically modified organisms. Three hours of lecture and three hours of lab.

- 4760 Introduction to Bioinformatics.** Four credits. Prerequisites: BIOL 1110, 1120, and CSCI 1170 or consent of instructor. Application of computer science to biological questions. Specifically applies to the computational aspects of data gathering, processing, storage, analysis, and visualization methods for use in revising and testing biological hypotheses. Students should have a strong background in either computer science or biology, be willing to learn about the other field in an accelerated fashion, and be willing to work cooperatively as part of an interdisciplinary team. Three hours of lecture/problem-solving per week.

Gulf Coast Research Laboratory

MTSU is an affiliate of the Gulf Coast (Miss.) Research Laboratory. Marine biology courses may be taken at the station during the summer and the credits transferred to MTSU. Summer course offerings are as follows:

BOT 331	Coastal Vegetation. Three credits.
BOT 341	Marine Botany. Four credits.
BOT 441	Salt Marsh Plant Ecology. Four credits.
CH 461	Marine Chemistry. Six credits.
GEO 431	Coastal Marine Geology. Three credits.
MIC 452	Marine Microbiology. Five credits.
MS 400	Special Problems in Marine Science. One-six credits.
MS 405	Special Topics in Marine Science. One-six credits.
MSE 431	Marine Science for Teachers I. Three credits.
MSE 432	Marine Science for Teachers II. Three credits.
MSE 433	Marine Science for Elementary Teachers. Three credits.
OCE 251	Oceanography I. Five credits.
OCE 252	Oceanography II. Five credits.
ZO 141	Introduction to Marine Zoology. Four credits.
ZO 361	Marine Invertebrate Zoology. Six credits.
ZO 362	Marine Vertebrate Zoology and Ichthyology. Six credits.
ZO 408	Comparative Histology of Marine Organisms. One-six credits.
ZO 442	Marine Fisheries Management. Four credits.
ZO 443	Behavior and Neurobiology of Marine Animals. Four credits.
ZO 447	Fauna and Faunistic Ecology of Tidal Marshes. Four credits.
ZO 448	Early Life History of Marine Fishes. Four credits.
ZO 452	Marine Ecology. Five credits.
ZO 464	Aquaculture. Six credits.

Honors College

The Department of Biology offers the following courses in Honors:

- BIOL 1030 (Fall/Spring Semester)
- BIOL 1110 (Fall/Spring Semester)
- BIOL 1120 (Spring Semester)
- BIOL 2120 (Fall Semester)
- BIOL 2230 (Spring Semester)
- BIOL 3160 (Spring Semester of even-numbered years)

Graduate Study

The Master of Science is offered in Biology. Requirements for this degree and a list of the courses offered for graduate credit are published in the Graduate Catalog.