### DEPARTMENTS

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### PROGRAMS

#### UNDERGRADUATE

**Associate**
- Civil Engineering Technology
- Industrial Technology

**Baccalaureate**
- Applied Physics
- Biology
- Chemistry
- Civil Engineering Technology
- Electromechanical Engineering Technology
- Engineering Graphics and Design
- Engineering Physics
- Geoscience
- Interior Design
- Manufacturing Technology
- Mathematics
- Occupational Safety and Health
- Physics
- Telecommunications Systems Management
- Wildlife and Conservation Biology

**Minor**
- Anthropology
- Archaeology
- Astronomy
- Biology
- Chemistry
- Earth Science
- Engineering Science
- Environmental Geology
- Environmental Technology
- Geographic Information Science
- Industrial Engineering and Technology
- Mathematics
- Occupational Safety and Health
- Physics
- Social Science
- Sustainability Studies
- Telecommunications Systems Management

**Certificate**
- Geographic Information Science

#### GRADUATE

**Master’s**
- Applied Engineering and Technology Management
- Biology
- Chemical Manufacturing Management
- Chemistry
- Geosciences
- Mathematics
- Occupational Safety and Health
- Sustainability Science
- Telecommunications Systems Management
- Watershed Science

**Certificate**
- Professional Telecommunications Systems Management
The departments in the Jesse D. Jones College of Science, Engineering and Technology have a proud history of preparing students for careers in biology, chemistry, engineering, engineering technology, geosciences, industrial technology, mathematics, occupational safety and health, physics, statistics, sustainability science, and telecommunications.

The college’s faculty are talented educators who make quality instruction a priority. They make themselves accessible to students and help them achieve their academic, professional, and career goals. Faculty continuously refine the curriculum which ensures that our degree programs are current and timely in addressing the needs and expectations of our students. The faculty are also recognized scholars who carry out interesting research projects with funding from a variety of national, state, and private agencies. Like some of the finest liberal arts colleges in the country, we use our research program to enhance the learning environment for our undergraduate and graduate students. Many Murray State students have the opportunity to work side-by-side with faculty trying to solve some of the most interesting questions facing the scientific community today. Our students, both undergraduate and graduate, have published the results of their research in national journals and presented their work at regional and national conferences. In addition, students at Murray State have the opportunity to gain valuable hands-on experience through our co-op and internship programs. These kinds of experiences give our graduates the edge they need when applying for graduate school, professional school, or when entering the job market.

Our students study in comfortable, modern facilities, including the new Gene W. Ray science campus. The departments of biology and chemistry are housed in two beautiful state-of-the-art buildings, the Biology Building and Jesse D. Jones Hall. A proposed third building to house the engineering and physics programs will complete the campus. The college also enjoys excellent facilities in the Collins Center for Industry and Technology, Faculty Hall, and Blackburn Science Building.

Murray State’s designation as a Commonwealth Center of Excellence for Reservoir Research and the Program of Distinction in Telecommunication Systems Management adds to our distinctiveness both in the state and in the national and international academic communities.

Your academic experience in our college will be different from that found at many universities. The student-centered faculty, excellent facilities, and attractive curricular tracks offered here will provide you with an education that you will value throughout your life and career.

Programs and Facilities

Program of Distinction in Telecommunication Systems Management. The telecommunications field, which incorporates networks of leading-edge technologies such as fiber optic systems, satellites, wireless, telephony and cable, is rapidly changing and growing. The changes taking place in this field are dramatically influencing how individuals and institutions communicate and how they conduct business. Technological advances in the telecommunications area have profoundly affected government, retail, finance, health care, education, industry and entertainment sectors. Murray State’s exciting program in telecommunications systems management is helping prepare our graduates to become the leaders in this important emerging field.

Watershed Studies Institute. Murray State University hosts one of the five designated Centers of Excellence in the Commonwealth of Kentucky. With funding support from agencies like the National Science Foundation, Department of Energy, Environmental Protection Agency, Tennessee Valley Authority and the Kentucky Department for Natural Resources, Murray State’s research program in ecosystem sciences is both nationally and internationally recognized.

Three distinct components make up the Institute: the Hancock Biological Station (HBS), the Mid-America Remote Sensing Center (MARC), and the Chemical Services Laboratory (CSL). The Institute’s primary mission is to provide the infrastructure, support, and intellect for education and research of watershed ecosystems.

The Watershed Studies Institute provides outstanding research opportunities for scientists from around the world to study the region’s unique environment. The Institute also provides Murray State University undergraduate and graduate students with an opportunity to engage in hands-on research with faculty who are at the vanguard of ecosystem science.

Mid-America Remote Sensing Center. Since the late 1970s when Murray State was declared the Commonwealth’s technology transfer agent for NASA’s Landsat satellite, MARC has distinguished itself in the area of remote sensing and Geographic Information Systems (GIS). Students from around the world have received classroom instruction and have been mentored in research by the MARC Associates, a group of faculty and staff with expertise in a wide variety of application areas, many of which are focused on natural and cultural resource areas including land cover mapping, archaeological site analysis, mineral exploration, water quality and wildlife habitat mapping, emergency preparedness, and demographic modeling. Research projects have been conducted for local, state, and federal agencies, the private sector, and the university. MARC provides training in remote sensing and GIS and acts as a resource center for those within and beyond the university. MARC is one component of the Watershed Studies Institute and, as such, maintains a GIS for the lower reaches of the Kentucky Lake drainage basin.

Hancock Biological Station. A year-round research and teaching facility located on beautiful Kentucky Lake, the HBS is one of the finest centers of its kind in the Midwest. HBS acts as the field research focal point for the Watershed Studies Institute and for the Ecological Consortium of Mid-America. The facilities, which include both faculty and student housing, are available year-round to all scientists interested in ecosystem research. Hancock Biological Station contains state-of-the-art laboratories for aquatic chemistry, scanning electron microscopy, ecology, wildlife and fisheries. A full-time technical staff operates the facilities. Field-oriented classes at the station attract students from around the nation. A wide variety of formal classes are offered each summer. These may include ecology, ornithology, limnology, field botany, stream ecology, reservoir ecology, scanning electron microscopy and vertebrate ecology. Independent research topics provide opportunities for individualized instruction and close interactions with researchers. Classes are open to undergraduates, graduate students, teachers and others interested in enhancing their knowledge of ecology, ecosystems and the natural environment.

Chemical Services Laboratory. The Chemical Services Laboratory offers analytical laboratory services for industries and institutions in the west Kentucky and greater Ohio Valley region. Services include analyses for environmental chemistry, ecotoxicology, trace element, and acid-deposition studies. In addition to serving the needs of the region, this laboratory offers an opportunity for instruction and training at both the undergraduate and graduate levels.

Note: L=literature; R=research; PT=professional training. See page 75.
Sustainability Studies Minor

The Sustainability Studies minor is an interdisciplinary exploration of sustainability issues focusing on the environment and/or sustainable development. Integrating knowledge and experiences from the sciences, engineering, agriculture, business, humanities, and arts, the minor is designed to complement any major area of study by focusing on ecological health, sustainable agriculture, and economic sustainability.

MINOR: Sustainability Studies

Total Minor Requirements ........................................ 22-24 hrs

Required Courses ......................................................... 10 hrs
BIO 103 Saving Planet Earth
ENG 371 Literature and the Environment
IDC 150 Issues in Sustainability Studies
PHI 376 Environmental Ethics

Restricted Electives ......................................................... 6 hrs
Choose two of the following:
AGR 353 World Food, Agriculture and Society
CET 284 Sustainable Design and Construction
REC 450 Recreational Use of Natural Resources

Unrestricted Electives ..................................................... 6-8 hrs
Chosen from the following with program coordinator approval:
AGR 345, 378, 455; ANT 320; ARC 314; BIO 112, 330, 506, 578; CHE 502, 513; ECO 345, 410; ENT 286; GSC 507, 524; PSY 373; SOC 325, 380, 455.
Note: Six hours of the minor must be upper-level courses completed at Murray State University.

Sustainability Science
Graduate Coordinator - Howard Whiteman
(270) 809-6753

The Sustainability Science program is an interdisciplinary master’s program within the Jones College of Science, Engineering, and Technology designed to prepare students for careers in sustainability or closely related fields that have sustainability needs. The course of study allows specialization in one of four tracks: Agricultural Sustainability, Environmental Sustainability, Industrial and Technical Sustainability, and Sustainability Education. All students must complete a core curriculum, two restricted electives, and advanced courses in their area of interest.

Requirements for Admission

Applicants must meet all Murray State University requirements (see Graduate Admissions). Additional requirements for unconditional and conditional admission are listed below.

Unconditional

• Baccalaureate degree in science-related field.
• At least a 3.0 undergraduate GPA.
• Composite GRE score of at least 297 (148 verbal + 149 quantitative).
• International students: TOEFL score of at least 527; iBT TOEFL of 71; or IELTS score of 6.0.

Conditional

Recommendation of the advisory committee; international students must meet minimum testing scores described above.

Master of Science in Sustainability Science

CIP 30.3301

Total Course Requirements ........................................... 30-32 hours

Core Requirements ..................................................... 17 hrs
CET 687 Sustainable Environmental Technology
GSC 601 Understanding Scientific Communication
GSC 607 Land Use Planning
WSC 601 Seminar in Sustainability Science
WSC 693 Sustainability Practicum I
WSC 694 Sustainability Practicum II
Restricted Electives

Choose two of the following:

AGR 643 Sustainable Agriculture
ARC 615 Environmental Archaeology
BIO 665 Biogeochemistry
MAT 665 Applied Statistics I

Unrestricted Electives

Choose elective hours from one of the following emphasis areas:

Agricultural Sustainability

AGR 636 Seminar in International Agriculture Systems
AGR 649 Weeds and Their Control
AGR 652 Agricultural Policy
AGR 655 Advanced Soil Fertility
AGR 661 Sustainable Agriculture
AGR 662 Principles of Agroecology
AGR 671 Advanced Precision Agriculture
AGR 674 Agricultural Irrigation and Water Systems
CHE 604 Fundamentals of Toxicology
CHE 613 Environmental Chemistry
GSC 612 Remote Sensing
GSC 621 Geographic Information Systems

Environmental Sustainability

AGR 662 Principles of Agroecology
ARC 610 Landscape Archaeology
ARC 615 Environmental Archaeology
BIO 635 Biogeography
BIO 642 Watershed Ecology
BIO 665 Biogeochemistry
BIO 675 Invasion Ecology
BIO 678 Conservation Biology
BIO 685 Restoration Ecology
BIO 690 Disturbance Ecology
CHE 604 Fundamentals of Toxicology
CHE 613 Environmental Chemistry
GSC 612 Remote Sensing
GSC 621 Geographic Information Systems

Industrial and Technical Sustainability

CET 655 Environmental Regulatory Affairs
CET 681 Pollution Assessment and Control
CET 682 Industrial Ecology
CET 686 Environmental Assessment and Remediation
CET 687 Sustainable Environmental Technology
CET 688 Waste Minimization and Pollution Prevention
CHE 600 Chemistry of Fuels
CHE 604 Fundamentals of Toxicology
CHE 613 Environmental Chemistry
IET 619 Industrial Energy Management
OSH 622 Toxicology of Industrial Materials
OSH 646 Fundamentals of Risk Control
OSH 687 Wastewater Treatment
OSH 689 Solid and Hazardous Waste Treatment

Sustainability Education

EDU 615 Introduction to Environmental Education
EDU 664 Techniques of Teaching Environmental Education
EDU 665 Field Experiences in Environmental Education
EDU 667 International Environmental Education
EDU 668 Agriculture and the Environment in the Classroom
Interdisciplinary Program in Watershed Science
Watershed Studies Institute
(270) 474-2272

The Watershed Studies Institute program in Watershed Science is an interdisciplinary master’s program within the Jones College of Science, Engineering and Technology designed to prepare students for careers or for further graduate studies in the broader aspects of watershed management and science. The thesis course of study allows students to concentrate on one of four tracks: aquatic ecology, environmental chemistry, hydrological spatial analysis, or watershed conservation. The non-thesis course of study is designed to fit individual educational goals and may be focused on any aspect of watershed science. All students must complete a core curriculum and advanced courses in their areas of interest.

Requirements for Admission
Applicants must meet all Murray State University requirements (see Graduate Admissions). A faculty member must agree to mentor the student. Additional requirements for unconditional and conditional admission are as follows:

Unconditional
- Baccalaureate degree in biology, chemistry, geosciences, mathematics, physics, or a closely related field.
- At least a 3.0 undergraduate GPA.
- Composite GRE score of at least 297.

Conditional
Recommendation of the advisory committee.

Master of Science in Watershed Science

CIP 26.1304

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<th>THESIS REQUIREMENTS ONLY</th>
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<td><strong>Total Course Requirements</strong></td>
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<td><strong>Core Requirements</strong></td>
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| BIO 642  
Watershed Ecology (same as GSC 642) | |
| BIO 696  
Understanding Scientific Communication | |
| CHE 613  
Environmental Chemistry | |
| GSC 665  
Physical/Chemical Limnology | |
| WSC 690  
Seminar | |
| WSC 698-699 Thesis | PT |

| **Specialization** | 18 hrs |

Courses must be approved by the advisory committee.

Aquatic Ecology
Choose two of the following:

| BIO 646  
Stream Ecology | |
| BIO 686  
Limnology | |
| BIO 688  
Reservoir Ecology | |
| BIO 669  
Biological Limnology | |
| BIO 670  
Limnological Analysis Laboratory | |
| CHE 665  
Biogeochemistry | |
| GSC 662  
Hydrogeology | |

and one of the following:

| BIO 661  
Freshwater Invertebrates | |
| BIO 663  
Aquatic Entomology | |
| BIO 671  
Ichthyology | |
| BIO 672  
Herpetology | |

and one of the following:

| BIO 630  
Animal Ecology | |
| BIO 631  
Plant Ecology | |
| BIO 632  
Quantitative Ecology | |
| BIO 682  
Waterfowl Management | |
| BIO 683  
Fisheries Management | |
Environmental Chemistry
CHE 617 Advanced Organic Chemistry
CHE 627 Chemical Separations
CHE 628 Mass Spectrometry
CHE 665 Biogeochemistry

Hydrological Spatial Analysis
Choose one of the following:
BIO 669 Biological Limnology
BIO 670 Limnological Analysis Laboratory
GSC 662 Hydrogeology

and three of the following:
CET 685 Remediation Technology
GSC 612 Remote Sensing
GSC 621 Geographic Information Systems
GSC 640 Advanced Remote Sensing
GSC 641 Digital Image Processing Research
GSC 680 Advanced Geographic Information Systems

Watershed Conservation
Choose two of the following:
BIO 646 Stream Ecology
BIO 669 Biological Limnology
BIO 670 Limnological Analysis Laboratory
BIO 686 Limnology
BIO 688 Reservoir Ecology
CHE 665 Biogeochemistry
GSC 662 Hydrogeology

and three of the following:
AGR 674 Agricultural Irrigation and Water Systems
BIO 678 Conservation Biology
BIO 682 Waterfowl Management
BIO 683 Fisheries Management
CET 655 Environmental Regulatory Affairs
CET 681 Pollution Assessment and Control
CET 685 Remediation Technology

Other Degree Requirements
- Successful completion of MAT 665 Applied Statistics I.
- Written and oral comprehensive examinations as specified by the advisory committee in broad aspects of watershed science and area of concentration (usually taken in third semester of residence).
- Defense of thesis.

NON-THESIS REQUIREMENTS

Total Course Requirements ........................................... 36 hours
Same as above with the following substitution for thesis:
BIO 669 Biological Limnology
CHE 665 Biogeochemistry
Specialization electives (decrease to 15 hrs)$^1$
Must include:
GSC 662 Hydrogeology

Other Degree Requirements
- Successful completion of MAT 665 Applied Statistics I.
- Written comprehensive examination in broad aspects of watershed science (usually taken in third semester of residence).
- Literature review on some aspect of watershed science, developed in collaboration with the faculty advisor. Successful written and oral presentation of the review counts as WSC 690.

$^1$As approved by advisor.
The Department of Biological Sciences offers baccalaureate programs with a major in biology (pre-medicine, pre-dentistry, pre-optometry, pre-physical therapy, pre-physician assistant, molecular biology, fisheries, aquatic biology and secondary certification tracks available) or an area of concentration in wildlife and conservation biology. These programs are designed to prepare students for professional or graduate work in the life sciences, such as the M.S. in biology offered by the department. Curricula provide students with a basic core of science courses plus advanced biology courses in their particular field of interest. The department also offers a two-year, pre-professional program in pharmacy and a minor in biology.

The department has offices, classrooms, laboratories, and research facilities in the newly constructed Biology Building and on the third floor of the Blackburn Science Building. The department also has two off-campus resources which are utilized in field-oriented teaching and research programs. One of these, Murphy’s Pond, is a 300-acre preserve in Hickman County with one of the few remaining cypress swamps in western Kentucky. The other, Hancock Biological Station, is a modern classroom/laboratory complex located on the western shore of Kentucky Lake, 17 miles from the main campus. The station is ideally located in an area of diverse aquatic habitats and is the focal point for the reservoir research on Kentucky Lake and Lake Barkley.

MAJOR:
Biology

Bachelor of Science/Bachelor of Arts Degree
CIP 26.0101

University Studies Requirements
............................................. 38-44 hrs
(See Academic Degrees and Programs.)

University Studies selections must include:
• Scientific Inquiry, Methodologies, and Quantitative Skills
  CHE 201 General College Chemistry
  CHE 202 General Chemistry and Qualitative Analysis
  MAT 150 Algebra and Trigonometry
  or
  MAT 250 Calculus and Analytic Geometry I

• University Studies Electives
  PHY 130 General Physics I
  PHY 131 General Physics I Laboratory
  or
  PHY 235 Mechanics, Heat and Wave Motion
  PHY 236 Mechanics, Heat and Wave Motion Laboratory

Required Courses ............................................................. 41 hrs
BIO 100T Transitions
BIO 115 The Cellular Basis of Life
BIO 216 Biological Inquiry and Analysis
BIO 221 Zoology: Animal Form and Function
BIO 222 Botany: Plant Form and Function
BIO 330 Principles of Ecology
BIO 333 Genetics
BIO 499 Senior Biology Seminar
BIO electives, 300-level or above (16 hrs)

Co-Requirements for Biology Major ........................................... 7-8 hrs

Group 1:
CHE 312 Organic Chemistry I
CHE 320 Organic Chemistry II

or Group 2:
CHE 210 Brief Organic Chemistry
CHE 215 Chemistry Laboratory
CHE 330 Basic Biochemistry
**AREA:**
**Biology/Biomedical Sciences Track\(^1\)**

**Bachelor of Science/Bachelor of Arts Degree**
CIP 26.0101

**University Studies Requirements** .......................... 38-44 hrs
(See Academic Degrees and Programs.)

University Studies selections must include:
• **Scientific Inquiry, Methodologies, and Quantitative Skills**
  CHE 201  General College Chemistry
  MAT 250  Calculus and Analytic Geometry I
  PHY 130  General Physics I\(^2\)
  PHY 131  General Physics I Laboratory\(^2\)
• **University Studies Electives**
  CHE 202  General Chemistry and Qualitative Analysis\(^2\)

**Required Courses** ............................................................ 46 hrs
BIO 100T Transitions
BIO 115  The Cellular Basis of Life
BIO 216  Biological Inquiry and Analysis\(^3\)
BIO 221  Zoology: Animal Form and Function\(^3\)
  or
BIO 222  Botany: Plant Form and Function\(^3\)
BIO 290  Biomedical Research I
BIO 300  Introductory Microbiology
BIO 321  Cell Biology: Mechanisms\(^4\)
  or
BIO 323  Cell Biology: Systems\(^4\)
BIO 322  Animal Physiology
BIO 333  Genetics
BIO 388  Biomedical Research II
BIO 389  Biomedical Research III
BIO 438  Biomedical Research IV
BIO 439  Biomedical Research V
BIO 499  Senior Biology Seminar
BIO 533  Molecular Genetics

**Co-Requirements for Area** .............................................. 18 hrs
CHE 312  Organic Chemistry I
CHE 320  Organic Chemistry II
CHE 530  Fundamentals of Biochemistry I
CHE 540  Fundamentals of Biochemistry II
PHY 132  General Physics II\(^2,3\)
PHY 133  General Physics II Laboratory\(^2,3\)

**Restricted Electives** .................................................... 15 hrs
Choose from the following:
BIO 308  Ethics in Biology\(^3\)
BIO 320  Comparative Vertebrate Anatomy
BIO 321  Cell Biology: Mechanisms\(^4\)
  or
BIO 323  Cell Biology: Systems\(^4\)
BIO 421  Vertebrate Histology
BIO 501  Immunology

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1. May be used to fulfill University Studies requirements.
2. A maximum of three hours total from BIO 483, 484 and BIO 491, 492, 493, 494 may be used. BIO 488 and 489 will not count here.
3. This course does not apply toward the chemistry minor.
4. Chemistry co-requirements may apply toward the requirements for a minor in chemistry.
BIO 504 Medical Cell Biology  
BIO 521 Cell Biology Laboratory  
BIO 528 Neurobiology  
BIO 534 Molecular Genetics Laboratory  
BIO 597 Topics in Advanced Molecular Biology  
CHE 305 Analytical Chemistry  
CHE 325 Organic Chemistry II Laboratory  
CHE 403 Basic Physical Chemistry  
PHY 370 Introduction to Modern Physics  

**Total Curriculum Requirements**  
120-129 hrs  

1A freshman must have a math ACT score of 25 or higher to declare a major in Biomedical Sciences. However, any student may apply to the program and must have completed 32 credit hours with a GPA of 3.0, and must have taken BIO 115, 216, CHE 201, 202 and MAT 250 with grades of B or better. Any student wishing to seek this degree (whether declared as a freshman or not) must apply to the Biomedical Sciences committee for admission into the program.  
2Required for area if not taken as a University Studies elective.  
3May be used to fulfill University Studies requirements.  
4Required for area as either Core choice or as a Restricted Elective.  

### MAJOR:  
#### Biology/Molecular Biology Track  

**Bachelor of Science/Bachelor of Arts Degree**  
CIP 26.0101  

**University Studies Requirements**  
38-44 hrs  
(See Academic Degrees and Programs.)  

University Studies selections must include:  

- **Scientific Inquiry, Methodologies, and Quantitative Skills**  
  - CHE 201 General College Chemistry  
  - MAT 250 Calculus and Analytic Geometry I  
  - PHY 130 General Physics I  
  - PHY 131 General Physics I Laboratory  
  
  or  
  
  - PHY 235 Mechanics, Heat and Wave Motion  
  - PHY 236 Mechanics, Heat and Wave Motion Laboratory  

- **University Studies Electives**  
  - CHE 202 General Chemistry and Qualitative Analysis  

**Required Courses**  
37 hrs  

- BIO 100T Transitions  
- BIO 115 The Cellular Basis of Life  
- BIO 216 Biological Inquiry and Analysis\(^1\)  
- BIO 221 Zoology: Animal Form and Function\(^1\)  
- BIO 222 Botany: Plant Form and Function\(^1\)  
- BIO 300 Introductory Microbiology  
- BIO 321 Cell Biology: Mechanisms  
  
  or  
  
  - BIO 323 Cell Biology: Systems  
  - BIO 333 Genetics  
  - BIO 499 Senior Biology Seminar  
  - BIO 533 Molecular Genetics  
  - BIO 534 Molecular Genetics Laboratory  
- BIO 597 Topics in Advanced Molecular Biology  

**Co-Requirements for Biology Major\(^2\)**  
21 hrs  

- CHE 312 Organic Chemistry I  
- CHE 320 Organic Chemistry II  
- CHE 530 Fundamentals of Biochemistry I  
- CHE 540 Fundamentals of Biochemistry II  
- MAT 560 Statistical Methods  
- PHY 132 General Physics II\(^1\)  
- PHY 133 General Physics II Laboratory\(^1\)  
  
  or  
  
  - PHY 255 Electricity, Magnetism and Light\(^1\)  
  - PHY 256 Electricity, Magnetism and Light Laboratory\(^1\)
MAJOR:
Biology/Pre-Medical/Pre-Dental Track

Bachelor of Science/Bachelor of Arts Degree
CIP 26.0101

University Studies Requirements ........................................ 38-44 hrs
(See Academic Degrees and Programs.)

University Studies selections must include:
• **Scientific Inquiry, Methodologies, and Quantitative Skills**
  CHE 201 General College Chemistry
  MAT 150 Algebra and Trigonometry
  or
  MAT 250 Calculus and Analytic Geometry I
  PHY 130 General Physics I
  PHY 131 General Physics I Laboratory
  or
  PHY 235 Mechanics, Heat and Wave Motion and
  PHY 236 Mechanics, Heat and Wave Motion Laboratory
• **Social and Self-Awareness and Responsible Citizenship**
  PSY 180 General Psychology (recommended)
• **University Studies Electives**
  CHE 202 General Chemistry and Qualitative Analysis

**Required Courses** ............................................................ 40 hrs
BIO 100T Transitions
BIO 115 The Cellular Basis of Life
BIO 216 Biological Inquiry and Analysis
BIO 221 Zoology: Animal Form and Function
BIO 222 Botany: Plant Form and Function
BIO 321 Cell Biology: Mechanisms
  or
  BIO 323 Cell Biology: Systems
BIO 322 Animal Physiology
BIO 333 Genetics
BIO 499 Senior Biology Seminar
BIO electives, 300-level or above (12 hrs)

**Co-Requirements for Biology Major** .................................... 12 hrs
CHE 312 Organic Chemistry I
CHE 320 Organic Chemistry II
PHY 132 General Physics II
PHY 133 General Physics II Laboratory
  or
  PHY 255 Electricity, Magnetism and Light and
  PHY 256 Electricity, Magnetism and Light Laboratory

**Required Minor** ............................................................ 3-21 hrs

**Unrestricted Electives** ................................................... 6-14 hrs

**Total Curriculum Requirements** ....................................... 120 hrs

1May be used to fulfill University Studies requirements.
2A maximum of three hours total from BIO 483, 484 and BIO 491, 492, 493, 494 may be used. BIO 488 and 489 will not count here.
3Chemistry co-requirements may apply toward chemistry minor.
4ENG 204 strongly recommended. Electives other than ENG 204 must be at the 300-level or above.
MAJOR:
Biology/Pre-Optometry Track

Bachelor of Science/Bachelor of Arts Degree
GIP 26.0101

University Studies Requirements ......................... 38-44 hrs
(See Academic Degrees and Programs.)

University Studies selections must include:
• Scientific Inquiry, Methodologies, and Quantitative Skills
  MAT 250  Calculus and Analytic Geometry I
  PHY 130  General Physics I
  PHY 131  General Physics I Laboratory
  or
  PHY 132  General Physics II
  PHY 133  General Physics II Laboratory
  and
  PHY 235  Mechanics, Heat and Wave Motion
  PHY 236  Mechanics, Heat and Wave Motion Laboratory
  or
  PHY 255  Electricity, Magnetism and Light
  PHY 256  Electricity, Magnetism and Light Laboratory
• Social and Self-Awareness and Responsible Citizenship
  PSY 180  General Psychology
• University Studies Electives
  CHE 201  General College Chemistry

Required Courses .................................................. 41 hrs
BIO 100T Transitions
BIO 115  The Cellular Basis of Life
BIO 216  Biological Inquiry and Analysis
BIO 221  Zoology: Animal Form and Function
BIO 222  Botany: Plant Form and Function
BIO 300  Introductory Microbiology
BIO 322  Animal Physiology
BIO 333  Genetics
BIO 499  Senior Biology Seminar
BIO electives, 300-level or above (12 hrs)

Co-Requirements for Biology Major............................. 23 hrs
CHE 202  General Chemistry and Qualitative Analysis
CHE 312  Organic Chemistry I
CHE 320  Organic Chemistry II
CHE 330  Basic Biochemistry
  or
CHE 530  Fundamentals of Biochemistry I
ENG 204  Advanced Expository Writing
MAT 135  Introduction to Probability and Statistics

Required Minor ...................................................... 0 hrs

Unrestricted Electives ............................................. 5-16 hrs

Total Curriculum Requirements ............................... 120 hrs

1May be used to fulfill University Studies requirements.
2A maximum of three hours total from BIO 483, 484 and BIO 491, 492, 493, 494 may be used. BIO 488 and 489 will not count here.
3Chemistry co-requirements may apply toward chemistry minor.
MAJOR:
Biology/Pre-Physical Therapy Track

Bachelor of Science/Bachelor of Arts Degree
CIP 26.0101

University Studies Requirements .......................... 38-44 hrs
(See Academic Degrees and Programs.)

University Studies selections must include:
• Scientific Inquiry, Methodologies, and Quantitative Skills
  CHE 201 General College Chemistry
  MAT 150 Algebra and Trigonometry
  or
  MAT 250 Calculus and Analytic Geometry I
  PHY 130 General Physics I
  PHY 131 General Physics I Laboratory
• Social and Self-Awareness and Responsible Citizenship
  PSY 180 General Psychology
• University Studies Electives
  CHE 202 General Chemistry and Qualitative Analysis

Required Courses ............................................... 24-25 hrs
BIO 100T Transitions
BIO 115 The Cellular Basis of Life
BIO 216 Biological Inquiry and Analysis
BIO 120 Scientific Etymology
BIO 221 Zoology: Animal Form and Function
BIO 222 Botany: Plant Form and Function
BIO 220 Clinical Terminology
BIO 300 Introductory Microbiology
  or
BIO 321 Cell Biology: Mechanisms
BIO 320 Comparative Vertebrate Anatomy
  or
BIO 227 Human Anatomy
  and
BIO 228 Human Anatomy Laboratory
BIO 322 Animal Physiology
BIO 333 Genetics
BIO 499 Senior Biology Seminar
BIO electives, approved by advisor, 300-level or above (9 hrs)
  (If BIO 320 is taken, only four hours of 300-level or above.)

Co-Requirements for Biology Major .......................... 24-25 hrs
BIO 450 Exercise Physiology
CHE 312 Organic Chemistry I
CHE 320 Organic Chemistry II
MAT 135 Introduction to Probability and Statistics
  or
PSY 300 Principles and Methods of Statistical Analysis
PHY 132 General Physics II
PHY 133 General Physics II Laboratory
PSY 260 Lifespan Development
SOC 133 Introduction to Sociology

Required Minor ................................................. 3-21 hrs

Unrestricted Electives ......................................... 0-12 hrs

Total Curriculum Requirements ............................ 120 hrs

1 May be used to fulfill University Studies requirements.
2 A maximum of three hours total from BIO 483, 484 and BIO 491, 492, 493, 494 may be used. BIO 488 and 489 will not count here.
3 Chemistry co-requirements may apply toward chemistry minor.
MAJOR:  
Biology/Pre-Physician Assistant Track

Bachelor of Science/Bachelor of Arts Degree  
CIP 26.0101

University Studies Requirements .................................. 38-44 hrs  
(See Academic Degrees and Programs.)

University Studies selections must include:

• **Scientific Inquiry, Methodologies, and Quantitative Skills**
  
  CHE 201 General College Chemistry
  MAT 150 Algebra and Trigonometry
  or
  MAT 250 Calculus and Analytic Geometry I
  PHY 130 General Physics I
  PHY 131 General Physics I Laboratory

• **Social and Self-Awareness and Responsible Citizenship**
  
  PSY 180 General Psychology
  SOC 133 Introduction to Sociology

• **University Studies Electives**
  
  CHE 202 General Chemistry and Qualitative Analysis

Required Courses ........................................................................... 40 hrs

BIO 100T Transitions
BIO 115 The Cellular Basis of Life
BIO 120 Scientific Etymology
BIO 216 Biological Inquiry and Analysis¹
BIO 220 Clinical Terminology
BIO 221 Zoology: Animal Form and Function¹
BIO 222 Botany: Plant Form and Function¹
BIO 300 Introductory Microbiology
BIO 321 Cell Biology: Mechanisms
or
BIO 323 Cell Biology: Systems
BIO 333 Genetics
BIO 499 Senior Biology Seminar
BIO electives, 300-level or above [10 hrs]² [BIO 488 and 489 will not count here]

Co-Requirements for Biology Major ........................................ 26-27 hrs

BIO 227 Human Anatomy
BIO 228 Human Anatomy Laboratory
BIO 229 Human Physiology
BIO 230 Human Physiology Laboratory
CHE 312 Organic Chemistry I
CHE 320 Organic Chemistry II
MAT 135 Introduction to Probability and Statistics¹
or
PSY 300 Principles and Methods of Statistical Analysis
PHY 132 General Physics II¹
PHY 133 General Physics II Laboratory¹
PSY 260 Lifespan Development

Required Minor (Chemistry recommended)³ ................................ 3 hrs

Unrestricted Electives ................................................................. 0-10 hrs

Total Curriculum Requirements ............................................. 120 hrs

¹May be used to fulfill University Studies requirements.
²A maximum of three hours total from BIO 483, 484 and BIO 491, 492, 493, 494 may be used. BIO 488 and 489 will not count here.
³Chemistry co-requirements may apply toward chemistry minor.
MAJOR:
Biology/Fisheries/Aquatic Biology Track

Bachelor of Science/Bachelor of Arts Degree
CIP 26.0101

University Studies Requirements ......................... 38-44 hrs
(See Academic Degrees and Programs.)

University Studies selections must include:
• Scientific Inquiry, Methodologies, and Quantitative Skills
  CHE 201 General College Chemistry
  MAT 150 Algebra and Trigonometry
  or
  MAT 250 Calculus and Analytic Geometry I
  PHY 130 General Physics I
  PHY 131 General Physics I Laboratory
• University Studies Electives
  MAT 135 Introduction to Probability and Statistics

Required Biology Courses ...................................... 44 hrs
BIO 100T Transitions
BIO 115 The Cellular Basis of Life
BIO 216 Biological Inquiry and Analysis
BIO 221 Zoology: Animal Form and Function
BIO 222 Botany: Plant Form and Function
BIO 330 Principles of Ecology
BIO 333 Genetics
BIO 499 Senior Biology Seminar
BIO 586 Limnology
and 15 hrs selected from the following:
BIO 542 Watershed Ecology
BIO 546 Stream Ecology
BIO 561 Freshwater Invertebrates
BIO 563 Aquatic Entomology
BIO 570 Ichthyology
BIO 582 Fisheries Management
BIO 587 Freshwater Biology
BIO 588 Reservoir Ecology

Co-Requirements for Biology Major .......................... 12-13 hrs
CHE 202 General Chemistry and Qualitative Analysis
and Group 1:
CHE 210 Brief Organic Chemistry
CHE 215 Brief Organic Chemistry Laboratory
CHE 330 Basic Biochemistry
or Group 2:
CHE 312 Organic Chemistry I
CHE 320 Organic Chemistry II

Required Minor ................................................. 3-21 hrs

Unrestricted Electives .......................................... 0-19 hrs

Total Curriculum Requirements ............................ 120 hrs

1 May be used to fulfill University Studies requirements.
2 This course does not apply toward the chemistry minor.
3 Chemistry co-requirements may apply toward chemistry minor.
MAJOR:  
Biology/Secondary Certification (Grades 8-12) Track  
Bachelor of Science/Bachelor of Arts Degree  
CIP 26.0101

University Studies Requirements ........................................... 38-44 hrs  
(See Academic Degrees and Programs.)

University Studies selections must include:  
**Scientific Inquiry, Methodologies, and Quantitative Skills**  
CHE 201 General College Chemistry  
CHE 202 General Chemistry and Qualitative Analysis  
MAT 150 Algebra and Trigonometry  
**Social and Self-Awareness and Responsible Citizenship**  
EDP 260 Psychology of Human Development  
**University Studies Electives**  
EDU 103 Issues and Practices of American Education¹  
PHY 130 General Physics I ²  
PHY 131 General Physics I Laboratory²  
Note: Certification requires a grade of B or better in one English composition course and a B or better in a University Studies math course, public speaking, and EDU 103 or equivalent course. Additional requirements for admission to teacher education and student teaching must be met. See advisor and/or Office of Teacher Education Services for details.

**Required Courses** .......................................................... 38 hrs  
BIO 100T Transitions  
BIO 115 The Cellular Basis of Life  
BIO 216 Biological Inquiry and Analysis  
BIO 221 Zoology: Animal Form and Function  
BIO 222 Botany: Plant Form and Function  
BIO 300 Introductory Microbiology  
BIO 320 Comparative Vertebrate Anatomy  
BIO 321 Evolutionary Biology  
BIO 322 Animal Physiology  
BIO 330 Principles of Ecology  
BIO 333 Genetics  
BIO 499 Senior Biology Seminar  

**Chemistry Requirement** ................................................. 11-12 hrs  
Group 1:  
CHE 312 Organic Chemistry I  
CHE 320 Organic Chemistry II  
*or Group 2:*  
CHE 210 Brief Organic Chemistry¹,⁴  
CHE 215 Brief Organic Chemistry Laboratory¹,⁴  
CHE 330 Basic Biochemistry  

**Physics Requirement**  
PHY 132 General Physics I  
PHY 133 General Physics II Laboratory²  

**Required for Secondary Certification⁶** ................................... 32 hrs  
EDU 303 Strategies of Teaching  
EDU 403 Structures and Foundations of Education  
EDU 405 Evaluation and Measurement in Education⁷  
SEC 420 Practicum in Secondary Schools⁵  
SEC 421 Student Teaching in the Secondary School  
SEC 422 Extended Practicum⁸  
SED 300 Educating Students with Disabilities  

**Required Minor⁹** ............................................................ 3-21 hrs

**Total Curriculum Requirements** ...................................... 128-137 hrs⁹  
¹With a grade of B or better.  
²PHY 235 and 236 will also meet this requirement.
Pre-Pharmacy Curriculum\(^1\)

**Required Courses** ................................. \(58\) hrs

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
</tr>
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<tbody>
<tr>
<td>BIO 221</td>
<td>Zoology: Animal Form and Function(^2)</td>
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<tr>
<td>BIO 227</td>
<td>Human Anatomy</td>
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<td>BIO 228</td>
<td>Human Anatomy Laboratory</td>
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<tr>
<td>BIO 300</td>
<td>Introductory Microbiology</td>
</tr>
<tr>
<td>CHE 201</td>
<td>General College Chemistry(^2)</td>
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<tr>
<td>CHE 202</td>
<td>General Chemistry and Qualitative Analysis(^2)</td>
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<tr>
<td>CHE 312</td>
<td>Organic Chemistry I</td>
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<tr>
<td>CHE 320</td>
<td>Organic Chemistry II</td>
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<td>CHE 325</td>
<td>Organic Chemistry II Laboratory</td>
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<tr>
<td>ECO 231</td>
<td>Principles of Microeconomics(^2)</td>
</tr>
<tr>
<td>ENG 105</td>
<td>Reading, Writing and Inquiry(^4)</td>
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<tr>
<td>ENG 204</td>
<td>Advanced Expository Writing(^4)</td>
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<tr>
<td>MAT 135</td>
<td>Introduction to Probability and Statistics(^4)</td>
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<tr>
<td>MAT 250</td>
<td>Calculus and Analytic Geometry I(^2)</td>
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<tr>
<td>PHY 130</td>
<td>General Physics I(^2)</td>
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<tr>
<td>PHY 131</td>
<td>General Physics I Laboratory(^2)</td>
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<tr>
<td>PHY 132</td>
<td>General Physics II(^2)</td>
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<tr>
<td>PHY 133</td>
<td>General Physics II Laboratory(^2)</td>
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<td></td>
<td>Elective hours:</td>
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<tr>
<td>Cross-cultural(^3)</td>
<td>(3) General electives (4)</td>
</tr>
<tr>
<td>Humanities(^4)</td>
<td>(6) Social and Self-Awareness and Responsible Citizenship (3)</td>
</tr>
</tbody>
</table>

**Total Curriculum Requirements** ................................. \(74\) hrs

\(^1\)The above program is based on the current admission requirements of the College of Pharmacy, University of Kentucky. Other colleges of pharmacy will have somewhat different requirements from those listed above. The curriculum can be modified to meet the requirements of most professional programs.

\(^2\)May be used to fulfill University Studies requirements if completing a B.A. or B.S. degree.

\(^3\)A course focusing on the study of a developing or non-Western country.

\(^4\)Must be a two-course series.

**AREA:**

**Wildlife and Conservation Biology/Conservation Biology Track**

**Bachelor of Science/Bachelor of Arts Degree**

**CIP 03.0601**

**University Studies Requirements** ................................. \(42-43\) hrs

(See Academic Degrees and Programs.)

University Studies selections must include:

- **Global Awareness, Cultural Diversity, and the World's Artistic Traditions**
  - POL 250 Introduction to International Relations
- **Scientific Inquiry, Methodologies, and Quantitative Skills**
  - MAT 135 Introduction to Probability and Statistics
  - CHE 105 Introductory Chemistry
    - or
  - CHE 201 General College Chemistry
  - MAT 150 Algebra and Trigonometry
    - or
  - MAT 250 Calculus and Analytical Geometry I
- **Social and Self-Awareness and Responsible Citizenship**
  - ECO 231 Principles of Microeconomics
• University Studies Electives
  BIO 216 Biological Inquiry and Analysis
  ENG 224 Writing for the Professions

Core Courses ................................................................. 62-65 hrs
  BIO 100T Transitions
  BIO 115 The Cellular Basis of Life
  BIO 149 Introduction to Wildlife and Conservation Biology
  BIO 221 Zoology: Animal Form and Function
  BIO 222 Botany: Plant Form and Function
  BIO 310 Vertebrate Natural History
  BIO 330 Principles of Ecology
  BIO 333 Genetics
  BIO 380 Wildlife Techniques
  BIO 499 Senior Biology Seminar
  BIO 578 Conservation Biology
  BIO 580 Principles of Wildlife Management
  BIO 584 Wildlife Policy and Administration
  BIO 554 Dendrology and Forest Conservation
  and
  BIO 350 Systematic Botany
  or
  BIO 553 Field Botany
  and one of the following:
  BIO 382 Scientific Communication for the Biologist
  ENG 324 Technical Writing
  and one of the following:
  BIO 572 Herpetology
  BIO 573 Ornithology
  BIO 574 Mammalogy
  and two of the following:
  AGR 345 Soil Science
  AGR 350 Soil Survey
  AGR 455 Soil Management
  CHE 210 Brief Organic Chemistry
  and
  CHE 215 Organic Chemistry Laboratory
  and
  GSC 199 Earth Science
  GSC 314 Sediments and Soils
  PHY 130 General Physics I
  and
  PHY 131 General Physics I Laboratory

Conservation Biology Track .......................................... 17 hrs
  GSC 202 Introduction to Geographical Information Science
  and one of the following:
  ECO 310 Issues in the Global Economy
  ECO 345 Environmental Economics

  and a minimum of ten hours from the following: 3
  ANT 320 Human Ecology
  BIO 240 Biological Applications in GIS
  BIO 300 Introductory Microbiology
  BIO 308 Ethics in Biology
  BIO 525 Biogeography
  BIO 548 Principles of Managing Diseases in Wildlife
  BIO 568 Wetland Ecology
  BIO 570 Ichthyology
  BIO 572 Herpetology
  BIO 573 Ornithology
  BIO 574 Mammalogy
  BIO 577 Population and Conservation Genetics
  BIO 581 Applied Wildlife Economics, Policy, and Administration
  BIO 590 Disturbance Ecology
  GSC 312 Introduction to Remote Sensing
  GSC 350 Field Techniques in Geosciences
AREA:
Wildlife and Conservation Biology/Conservation Education and Interpretation Track

Bachelor of Science/Bachelor of Arts Degree
CIP 03.0601

University Studies Requirements ......................... 42-43 hrs
(See Academic Degrees and Programs.)

University Studies selections must include:
• **Scientific Inquiry, Methodologies, and Quantitative Skills**
  MAT 135 Introduction to Probability and Statistics
  CHE 105 Introductory Chemistry
  or
  CHE 201 General College Chemistry
  MAT 150 Algebra and Trigonometry
  or
  MAT 250 Calculus and Analytical Geometry I
• **Social and Self-Awareness and Responsible Citizenship**
  EDP 260 Psychology of Human Development
  HIS 221 American Experience to 1865
  or
  HIS 222 American Experience since 1865
• **University Studies Electives**
  BIO 216 Biological Inquiry and Analysis
  ENG 224 Writing for the Professions

Core Courses ............................................... 62-65 hrs
BIO 100T Transitions
BIO 115 The Cellular Basis of Life
BIO 149 Introduction to Wildlife and Conservation Biology
BIO 221 Zoology: Animal Form and Function
BIO 222 Botany: Plant Form and Function
BIO 310 Vertebrate Natural History
BIO 330 Principles of Ecology
BIO 333 Genetics
BIO 380 Wildlife Techniques
BIO 499 Senior Biology Seminar
BIO 578 Conservation Biology
BIO 580 Principles of Wildlife Management
BIO 584 Wildlife Policy and Administration
BIO 554 Dendrology and Forest Conservation
  and
BIO 350 Systematic Botany
  or
BIO 553 Field Botany
  and one of the following:
BIO 382 Scientific Communication for the Biologist
ENG 324 Technical Writing
  and one of the following:
BIO 572 Herpetology
BIO 573 Ornithology
BIO 574 Mammalogy
  and two of the following:
AGR 345 Soil Science
AGR 350  Soil Survey
AGR 455  Soil Management
CHE 210  Brief Organic Chemistry
CHE 215  Organic Chemistry Laboratory
GSC 199  Earth Science
GSC 314  Sediments and Soils
PHY 130  General Physics I
PHY 131  General Physics I Laboratory

Conservation Education and Interpretation Track ............... 17 hrs
EDU 404  Teaching Environmental Education
REC 202  Recreation Program Planning

and a minimum of 13 hours from the following:¹
BIO 240  Biological Applications in GIS
BIO 525  Biogeography
BIO 542  Watershed Ecology
BIO 546  Stream Ecology
BIO 561  Freshwater Invertebrates
BIO 563  Aquatic Entomology
BIO 564  Entomology
BIO 568  Wetland Ecology
BIO 570  Ichthyology
BIO 572  Herpetology
BIO 573  Ornithology
BIO 574  Mammalogy
BIO 590  Disturbance Ecology
GSC 202  Introduction to Geographical Information Science
GSC 306  Landscapes of the National Parks
GSC 350  Field Techniques in Geosciences
GSC 512  Remote Sensing
GSC 521  Geographic Information Systems
PLN 507  Land Use Planning
REC 411  Curriculum Development in Adventure Education
REC 450  Recreational Use of Natural Resources
REC 465  Interpretation of Cultural and Natural Resources

Total Curriculum Requirements ....................... 121-125 hrs
¹Meets course requirements for Associate Wildlife Biologist Certification from The Wildlife Society.
²Only one course from BIO 572, 573, and 574 (if not taken as a core course) will count toward this requirement.

AREA:
Wildlife and Conservation Biology/Conservation Law Enforcement Track

Bachelor of Science/Bachelor of Arts Degree
CIP 03.0601

University Studies Requirements ...................... 42-43 hrs
(See Academic Degrees and Programs.)

University Studies selections must include:
• Scientific Inquiry, Methodologies, and Quantitative Skills
  MAT 135  Introduction to Probability and Statistics
  CHE 105  Introductory Chemistry
  or
  CHE 201  General College Chemistry
  MAT 150  Algebra and Trigonometry
  or
  MAT 250  Calculus and Analytical Geometry I
• Social and Self-Awareness and Responsible Citizenship
  CRJ 140  Introduction to Criminal Justice
  PSY 180  General Psychology
University Studies Electives

BIO 216 Biological Inquiry and Analysis
ENG 224 Writing for the Professions

Core Courses 1 .................................................. 62-65 hrs

BIO 100T Transitions
BIO 115 The Cellular Basis of Life
BIO 149 Introduction to Wildlife and Conservation Biology
BIO 221 Zoology: Animal Form and Function
BIO 222 Botany: Plant Form and Function
BIO 310 Vertebrate Natural History
BIO 330 Principles of Ecology
BIO 333 Genetics
BIO 380 Wildlife Techniques
BIO 499 Senior Biology Seminar
BIO 578 Conservation Biology
BIO 580 Principles of Wildlife Management
BIO 584 Wildlife Policy and Administration
BIO 554 Dendrology and Forest Conservation

and

BIO 350 Systematic Botany

or

BIO 553 Field Botany

and one of the following:

BIO 382 Scientific Communication for the Biologist
ENG 324 Technical Writing

and one of the following:

BIO 572 Herpetology
BIO 573 Ornithology
BIO 574 Mammalogy

and two of the following:

AGR 345 Soil Science
AGR 350 Soil Survey
AGR 455 Soil Management
CHE 210 Brief Organic Chemistry

and

CHE 215 Organic Chemistry Laboratory
GSC 199 Earth Science
GSC 314 Sediments and Soils
PHY 130 General Physics I

and

PHY 131 General Physics I Laboratory

Conservation Law Enforcement Track ............................. 17 hrs

CRJ 220 Law Enforcement
CRJ 300 Crime and Criminals

and a minimum of eleven hours from the following: 2

BIO 240 Biological Applications in GIS
BIO 548 Principles of Managing Diseases in Wildlife
BIO 570 Ichthyology
BIO 572 Herpetology
BIO 573 Ornithology
BIO 574 Mammalogy
BIO 581 Applied Wildlife Economics, Policy, and Administration
BIO 582 Fisheries Management
CRJ 240 Corrections
CRJ 346 Crime Investigation
CRJ 365 Interviewing and Interrogation
CRJ 445 Criminal Justice Diversity
GSC 202 Introduction to Geographical Information Science
REC 465 Interpretation of Cultural and Natural Resources

Total Curriculum Requirements ................................. 121-125 hrs

1 Meets course requirements for Associate Wildlife Biologist Certification from The Wildlife Society.
2 Only one course from BIO 572, 573, and 574 (if not taken as a core course) will count toward this requirement.
AREA:
Wildlife and Conservation Biology/Wildlife Biology Track

Bachelor of Science/Bachelor of Arts Degree
CIP 03.0601

University Studies Requirements .................................. 42-43 hrs
(See Academic Degrees and Programs.)

University Studies selections must include:
*Scientific Inquiry, Methodologies, and Quantitative Skills
MAT 135 Introduction to Probability and Statistics
CHE 105 Introductory Chemistry
or
CHE 201 General College Chemistry
MAT 150 Algebra and Trigonometry
or
MAT 250 Calculus and Analytical Geometry I
*Social and Self-Awareness and Responsible Citizenship
ECO 231 Principles of Microeconomics
*University Studies Electives
BIO 216 Biological Inquiry and Analysis
ENG 224 Writing for the Professions

Core Courses† .............................................................. 62-65 hrs
BIO 100T Transitions
BIO 115 The Cellular Basis of Life
BIO 149 Introduction to Wildlife and Conservation Biology
BIO 221 Zoology: Animal Form and Function
BIO 222 Botany: Plant Form and Function
BIO 310 Vertebrate Natural History
BIO 330 Principles of Ecology
BIO 333 Genetics
BIO 380 Wildlife Techniques
BIO 499 Senior Biology Seminar
BIO 578 Conservation Biology
BIO 580 Principles of Wildlife Management
BIO 584 Wildlife Policy and Administration
BIO 554 Dendrology and Forest Conservation
and
BIO 350 Systematic Botany
or
BIO 553 Field Botany
and one of the following:
BIO 382 Scientific Communication for the Biologist
ENG 324 Technical Writing
and one of the following:
BIO 572 Herpetology
BIO 573 Ornithology
BIO 574 Mammalogy
and two of the following:
AGR 345 Soil Science
AGR 350 Soil Survey
AGR 455 Soil Management
CHE 210 Brief Organic Chemistry
and
CHE 215 Organic Chemistry Laboratory
GSC 199 Earth Science
GSC 314 Sediments and Soils
PHY 130 General Physics I
and
PHY 131 General Physics I Laboratory
Wildlife Biology Track ................................................. 17 hrs

GSC 202 Introduction to Geographical Information Science

and a minimum of 13 hours from the following:³

AGR 240 Crop Science
BIO 240 Biological Applications in GIS
BIO 320 Comparative Vertebrate Anatomy
BIO 525 Biogeography
BIO 548 Principles of Managing Diseases in Wildlife
BIO 568 Wetland Ecology
BIO 570 Ichthyology
BIO 572 Herpetology
BIO 573 Ornithology
BIO 574 Mammalogy
BIO 577 Population and Conservation Genetics
BIO 581 Applied Wildlife Economics, Policy, and Administration
BIO 582 Fisheries Management
EDU 404 Teaching Environmental Education
GSC 312 Introduction to Remote Sensing
GSC 512 Geographic Information Systems
GSC 521 Geographic Information Systems
MAT 554 Statistical Methods
PLN 507 Urban and Regional Land Use Planning
REC 465 Interpretation of Cultural and Natural Resources

Total Curriculum Requirements .................................. 121-125 hrs

¹Meets course requirements for Associate Wildlife Biologist Certification from The Wildlife Society.
²Only one course from BIO 570, 572, 573, and 574 (if not taken as a core course) will count toward this requirement.

AREA:
Wildlife and Conservation Biology/Zoological Conservation Track

Bachelor of Science/Bachelor of Arts Degree
CIP 03.0601

University Studies Requirements .............................. 42-43 hrs
(See Academic Degrees and Programs.)

University Studies selections must include:

• Scientific Inquiry, Methodologies, and Quantitative Skills
  MAT 135 Introduction to Probability and Statistics
  CHE 105 Introductory Chemistry
  or
  CHE 201 General College Chemistry
  MAT 150 Algebra and Trigonometry
  or
  MAT 250 Calculus and Analytical Geometry I

• University Studies Electives
  BIO 216 Biological Inquiry and Analysis
  ENG 224 Writing for the Professions

Core Courses¹ ......................................................... 62-65 hrs

BIO 100T Transitions
BIO 115 The Cellular Basis of Life
BIO 149 Introduction to Wildlife and Conservation Biology
BIO 221 Zoology: Animal Form and Function
BIO 222 Botany: Plant Form and Function
BIO 310 Vertebrate Natural History
BIO 330 Principles of Ecology
BIO 333 Genetics
BIO 380 Wildlife Techniques
BIO 499 Senior Biology Seminar
BIO 578 Conservation Biology
BIO 580 Principles of Wildlife Management
BIO 584  Wildlife Policy and Administration
BIO 554  Dendrology and Forest Conservation
and
BIO 350  Systematic Botany
or
BIO 553  Field Botany
and one of the following:
BIO 382  Scientific Communication for the Biologist
ENG 324  Technical Writing
and one of the following:
BIO 572  Herpetology
BIO 573  Ornithology
BIO 574  Mammalogy
and two of the following:
AGR 345  Soil Science
AGR 350  Soil Survey
AGR 455  Soil Management
CHE 210  Brief Organic Chemistry
and
CHE 215  Organic Chemistry Laboratory
GSC 199  Earth Science
GSC 314  Sediments and Soils
PHY 130  General Physics I
and
PHY 131  General Physics I Laboratory

Zoological Biology Track............................................. 17 hrs
AGR 300  Principles of Animal Nutrition
AGR 310  Applications in Animal Technology
AGR 322  Veterinary Laboratory Principles
EDU 404  Teaching Environmental Education

and a minimum of seven hours from the following:2
AGR 324  Veterinary Diagnostic Imaging
AGR 329  Veterinary Hematology and Microbiology
AGR 332  Veterinary Nursing
BIO 240  Biological Applications in GIS
BIO 300  Introductory Microbiology
BIO 322  Animal Physiology
BIO 467  General Parasitology
BIO 538  Animal Behavior
BIO 539  Animal Behavior Laboratory
BIO 548  Principles of Managing Diseases in Wildlife
BIO 570  Ichthyology
BIO 572  Herpetology
BIO 573  Ornithology
BIO 574  Mammalogy
BIO 577  Population and Conservation Genetics
REC 465  Interpretation of Cultural and Natural Resources

Total Curriculum Requirements ................................... 121-125 hrs
1Meets course requirements for Associate Wildlife Biologist Certification from The Wildlife Society.
2Only one course from BIO 572, 573, and 574 (if not taken as a core course) will count toward this requirement.

Biology Minor.............................................................. 21 hrs
Complete BIO 115, 216, and either 221 or 222 (or both). A maximum of three hours total from BIO 483, 484, 491, 492, 493, or 494 may be used. Remaining BIO hours should be chosen with advisor’s approval (BIO 330 and 333 are highly recommended). BIO 101, 488, 489, and 499 will not count toward this minor. Six hours must be upper-level (300 and greater) courses completed at Murray State University.
Graduate Program
Graduate Coordinator - Michael Flinn

The Department of Biological Sciences offers the Master of Science degree. The M.S. program is designed to prepare the student to assume an active career in teaching and/or research or to pursue further graduate studies.

Requirements for Admission
Applicants must meet the Murray State University requirements (see Graduate Admissions). A faculty member must agree to mentor the student. Additional requirements for unconditional and conditional admission are as follows.

Unconditional
- Undergraduate courses in botany, zoology, ecology, and genetics.
- Eight undergraduate hours in chemistry.
- Composite GRE score of 300 (V+Q) or higher on current scale or 1,000 (V+Q) or higher on prior scale.

Conditional
Recommendation of the advisory committee.

Master of Science in Biology
CIP 26.0101

Within the guidelines, the individual’s program is developed by an advisory committee to ensure proficiency in the basic areas of zoology, botany, ecology and genetics. The thesis track is strongly recommended for anyone considering further research or graduate activities.

THESIS REQUIREMENTS

Total Course Requirements ............................................ 30 hours
BIO 689 Introduction to Graduate Study
BIO 696 Understanding Scientific Communication¹
BIO 697 Seminar
BIO 698-699 Thesis
BIO 600-level and above courses (9-20 hrs)
Graduate advisor/committee approved courses in related fields (0-11 hrs)

Other Degree Requirements
- Proficiency in quantitative methods through MAT 665 or a graduate course in bioinformatics, such as BIO 657.
- A preliminary examination will be given in the student’s first semester to assess the student’s understanding of principles across the diverse disciplines of biology.
- Oral defense of thesis.

NON-THESIS REQUIREMENTS

Total Course Requirements ............................................ 36 hours
BIO 689 Introduction to Graduate Study
BIO 696 Understanding Scientific Communication¹
BIO 697 Seminar
BIO 600-level and above courses (16-32 hrs)
Graduate advisor/committee approved courses in related fields (0-16 hrs)

Other Degree Requirements
- Proficiency in quantitative methods through MAT 665 or a graduate course in bioinformatics, such as BIO 657.
- A preliminary examination will be given in the student’s first semester to assess the student’s understanding of principles across the diverse disciplines of biology.

Optional Degree Requirement
- BIO 695 Biological Research (4) with prior approval of the research topic by the student’s graduate committee; results to be presented while enrolled in BIO 697. Research credits can be counted toward the 36-hour requirement.
Master of Arts in Education Secondary Teacher Leader with Biology Concentration

CIP 13.1205

The Department of Biological Sciences provides instruction in support of the M.A.Ed. in Secondary Teacher Leader with a concentration in biology. Prospective students should contact the graduate coordinator in the College of Education and Human Services for details on advising and graduate program design.

Department of Chemistry
1201 Jesse D. Jones Hall
270-809-2584

Chair: Harry Fannin. Faculty: Allenbaugh, Cox, Fannin, Fawzy, Horne, Johnson, Loganathan, McCreary, Miller, Ratliff, Revell, Volp.

The Department of Chemistry is certified by the American Chemical Society's Committee on Professional Training. The department offers an area in chemistry or a major with tracks in biochemistry, forensics, polymer and materials science, pre-medical, pre-dental, pre-pharmacy, pre-MBA, or teacher certification.

The chemistry area program is designed for students planning careers in engineering, the chemical industry, or for those who plan to pursue graduate study following the baccalaureate degree. Upon completion of this program, graduates are certified as professional chemists. Alumni with the area are well prepared to succeed in nationally recognized Ph.D. programs in chemistry.

The chemistry major program is recommended for students planning careers in medicine, dentistry, veterinary medicine, pharmacy, secondary education, toxicology, or biochemistry.

The department offers a minor in chemistry as well as a Master of Science in Chemistry.

Murray State has nationally recognized chemistry student organizations, the Student Members of the American Chemical Society, the Forensic Science Student Association, and a national chemistry honor society-Gamma Sigma Epsilon.

The department is closely aligned with the Chemical Services Laboratory (CSL), the Watershed Studies Institute (WSI), and efforts to enhance environmental and biomedical sciences at Murray State University.

An excellent undergraduate research program is maintained that allows students to become involved in research projects during their first semester at MSU or later if they so desire. Students present posters or talks each semester at local and/or national meetings.

Students interested in chemistry, should contact the chair of the Department of Chemistry, Murray State University, 1201 Jesse D. Jones Hall, Murray, KY 42071-3300, Phone: (270) 809-2584 Fax: (270) 809-6474, or visit our website at www.murraystate.edu/chemistry.

AREA:
Chemistry

Bachelor of Science/Bachelor of Arts Degree
CIP 40.0501

ACCREDITED BY:
American Chemical Society

University Studies Requirements ........................................... 43-46 hrs
(See Academic Degrees and Programs.)

University Studies selections must include:

- Scientific Inquiry, Methodologies, and Quantitative Skills
  MAT 250 Calculus and Analytic Geometry I
  PHY 235 Mechanics, Heat and Wave Motion
  PHY 236 Mechanics, Heat and Wave Motion Lab
  PHY 255 Electricity, Magnetism and Light
  PHY 256 Electricity, Magnetism and Light Lab

Required Courses ............................................................ 62 hrs
CHE 100T Transitions
CHE 201 General College Chemistry
CHE 202 General Chemistry and Qualitative Analysis
CHE 305 Analytical Chemistry
CHE 312 Organic Chemistry I
CHE 320 Organic Chemistry II
CHE 325 Organic Chemistry II Laboratory
CHE 400 Chemical Literature
CHE 401 Ethics for the Chemist
CHE 410 Physical Chemistry I
CHE 420 Physical Chemistry II
CHE 509 Advanced Inorganic Chemistry I
CHE 510 Inorganic Chemistry Laboratory
CHE 519 Instrumental Analysis
CHE 530 Fundamentals of Biochemistry I
CSC 235 Programming in C++
MAT 308 Calculus and Analytic Geometry II
MAT 309 Calculus and Analytic Geometry III

Required Limited Electives\(^3\) .................................................. 3 hrs
CHE 488 Cooperative Education/Internship
   or
CHE 495 Senior Research

Unrestricted Electives ......................................................... 9-12 hrs

Total Curriculum Requirements ........................................ 120 hrs
\(^1\)Required for area if not taken as a University Studies elective.
\(^2\)CSC 232 or EGR 140 may be substituted.
\(^3\)In conjunction with this program it is possible through careful course selection to obtain an M.S. degree with one additional year of study following the awarding of the B.S. degree. Students interested in this M.S. concentration should contact the graduate coordinator in the department no later than during the junior year.

MAJOR:
Chemistry

Bachelor of Science/Bachelor of Arts Degree
CIP 40.0501

University Studies Requirements .................................. 41-44 hrs
(See Academic Degrees and Programs.)

University Studies selections must include:

**Scientific Inquiry, Methodologies, and Quantitative Skills**
MAT 250 Calculus and Analytic Geometry I\(^1\)
PHY 130 General Physics I\(^1\) and
PHY 131 General Physics I Laboratory\(^1\)
PHY 132 General Physics II\(^1\) and
PHY 133 General Physics II Laboratory\(^1\)

Required Courses ........................................................................ 35 hrs
CHE 100T Transitions
CHE 201 General College Chemistry
CHE 202 General Chemistry and Qualitative Analysis
CHE 305 Analytical Chemistry
CHE 312 Organic Chemistry I
CHE 320 Organic Chemistry II
CHE 352 Basic Chemical Instrumentation
CHE 403 Basic Physical Chemistry
CSC 235 Programming in C++

Required Limited Electives .................................................. 3 hrs
CHE 488 Cooperative Education/Internship
   or
CHE 495 Senior Research

Required Minor ........................................................................ 21 hrs

Electives\(^3\) ........................................................................... 17-20 hrs

Total Curriculum Requirements ........................................ 120 hrs
\(^1\)Required for major if not taken as a University Studies elective.
\(^2\)CSC 232 or EGR 140 may be substituted.
\(^3\)At least one three-hour free elective must be chosen from outside Chemistry and may not be counted as a University Studies requirement.
MAJOR:
Chemistry/Secondary Certification (Grades 8-12) Track

Bachelor of Science/Bachelor of Arts Degree
CIP 40.0501

NOTE: Requirements for teacher certification are established by the Kentucky Education Professional Standards Board. Students are cautioned that requirements may change. For current information, students should check with an advisor in the Department of Adolescent, Career and Special Education.

University Studies Requirements ........................................... 41-50 hrs
(See Academic Degrees and Programs.)

University Studies selections must include:
• Scientific Inquiry, Methodologies, and Quantitative Skills
  MAT 250 Calculus and Analytic Geometry
  PHY 130 General Physics I
  PHY 131 General Physics I Laboratory
  PHY 132 General Physics II
  PHY 133 General Physics II Laboratory
• Social and Self-Awareness and Responsible Citizenship
  EDP 260 Psychology of Human Development
• University Studies Electives
  CSC 199 Introduction to Information Technology
  EDU 103 Issues and Practices of American Education

Note: Certification requires a grade of B or better in one English composition course and a B or better in a University Studies math course, public speaking, and EDU 103 or equivalent course. Additional requirements for admission to teacher education and student teaching must be met. See advisor and/or Office of Teacher Education Services for details.

Required Courses ............................................................... 30 hrs
CHE 100T Transitions
CHE 120 Chemical Laboratory Safety
CHE 201 General College Chemistry
CHE 202 General Chemistry and Qualitative Analysis
CHE 305 Analytical Chemistry
CHE 312 Organic Chemistry I
CHE 320 Organic Chemistry II
CHE 403 Basic Physical Chemistry

Required Limited Electives .................................................. 3-4 hrs
Select from the following:
CHE 330 Basic Biochemistry
CHE 352 Basic Chemical Instrumentation
CHE 504 Fundamentals of Toxicology
CHE 513 Environmental Chemistry

Secondary Certification Courses ......................................... 32 hrs
EDU 303 Strategies of Teaching
EDU 403 Structures and Foundations of Education
EDU 405 Evaluation and Measurement in Education
SEC 420 Practicum in Secondary Schools
SEC 421 Student Teaching in the Secondary School
SEC 422 Extended Practicum
SED 300 Educating Students with Disabilities

Required Minor ....................................................................... 21 hrs

Total Curriculum Requirements ....................................... 127-136 hrs

1Required for major if not taken as a University Studies elective. Students pursuing a Physics minor may substitute PHY 235/236 and 255/256 for PHY 130/131 and 132/133.
2Required for secondary certification if not taken as a University Studies elective.
3May substitute CSC 232 or EGR 140, but these will not count for University Studies electives.
4With a grade of C or better.
5EDU 405 and SEC 420 must be taken together and two semesters before student teaching.
6Must be taken one semester before student teaching.
Chemistry Teaching Specialization

The teaching specialization in chemistry is a path to secondary certification in chemistry, designed to accompany certification in another science content area. (All College of Education and Human Services secondary certification course requirements must be met.) The teaching specialization in chemistry meets and exceeds Murray State University’s requirements for a minor in chemistry. **Note:** Even though this program exceeds Murray State University’s requirements for a chemistry minor, in order for a chemistry minor to appear on a transcript, a minor must be declared, and all residential and graduation requirements must be met. Requirements for teacher certification are established by the Kentucky Education Professional Standards Board. Students are cautioned that changes in these requirements may occur. Therefore, for the most current information, students should check with an advisor in the College of Education and Human Services.

**Chemistry Teaching Specialization ...................................... 24 hrs**
CHE 120 Chemical Laboratory Safety  
CHE 201 General College Chemistry  
CHE 202 General Chemistry and Qualitative Analysis  
CHE 305 Analytical Chemistry  
CHE 312 Organic Chemistry I  
Choose one elective from the following:  
CHE 320 Organic Chemistry II  
CHE 352 Basic Chemical Instrumentation  
CHE 330 Basic Biochemistry  
CHE 403 Basic Physical Chemistry

**MAJOR:**

**Chemistry/Pre-Medical/Pre-Dental Track**

Bachelor of Science/Bachelor of Arts Degree  
CIP 40.0501

University Studies Requirements ................................. 41-44 hrs  
(See *Academic Degrees and Programs.*)

University Studies selections must include:  
*Scientific Inquiry, Methodologies, and Quantitative Skills*  
MAT 250 Calculus and Analytic Geometry I\(^1\)  
PHY 130 General Physics I\(^1\)  
PHY 131 General Physics I Laboratory\(^1\)  
PHY 132 General Physics II\(^1\)  
PHY 133 General Physics II Laboratory\(^1\)

Required Courses .................................................. 38 hrs  
CHE 100T Transitions  
CHE 201 General College Chemistry  
CHE 202 General Chemistry and Qualitative Analysis  
CHE 305 Analytical Chemistry  
CHE 312 Organic Chemistry I  
CHE 320 Organic Chemistry II  
CHE 352 Basic Chemical Instrumentation  
CHE 403 Basic Physical Chemistry  
CHE 530 Fundamentals of Biochemistry I  
CSC 235 Programming in C++\(^2\)  
ENG 204 Advanced Expository Writing  
or  
ENG 324 Technical Writing

Required Minor\(^3\) ................................................. 21 hrs

Unrestricted Electives ............................................. 17-20 hrs

Total Curriculum Requirements ................................ 120 hrs

\(^1\)Required for major if not taken as a University Studies elective.  
\(^2\)CSC 232 or EGR 140 may be substituted.  
\(^3\)Biology minor strongly recommended.
MAJOR: Chemistry/Biochemistry Track

Bachelor of Science/Bachelor of Arts Degree
CIP 40.0501

University Studies Requirements ........................................ 41-44 hrs
(See Academic Degrees and Programs.)

University Studies selections must include:
• Scientific Inquiry, Methodologies, and Quantitative Skills
  MAT 250 Calculus and Analytic Geometry I
  PHY 130 General Physics I and
  PHY 131 General Physics I Laboratory
  PHY 132 General Physics II and
  PHY 133 General Physics II Laboratory

Required Courses ............................................................ 44 hrs
CHE 100T Transitions
CHE 201 General College Chemistry
CHE 202 General Chemistry and Qualitative Analysis
CHE 305 Analytical Chemistry
CHE 312 Organic Chemistry I
CHE 320 Organic Chemistry II
CHE 352 Basic Chemical Instrumentation
CHE 403 Basic Physical Chemistry
CHE 530 Fundamentals of Biochemistry I
CHE 537 Experimental Biochemistry
CHE 540 Fundamentals of Biochemistry II
CSC 235 Programming in C++

Required Minor3 ............................................................. 21 hrs

Electives ................................................................. 11-14 hrs

Total Curriculum Requirements ........................................ 120 hrs
1Required for major if not taken as a University Studies elective.
2CSC 232 or EGR 140 may be substituted.
3Biology minor is strongly recommended.

MAJOR: Chemistry/Forensics Track

Bachelor of Science/Bachelor of Arts Degree
CIP 40.0501

University Studies Requirements ........................................ 41-44 hrs
(See Academic Degrees and Programs.)

University Studies selections must include:
• Scientific Inquiry, Methodologies, and Quantitative Skills
  MAT 250 Calculus and Analytic Geometry I
  PHY 130 General Physics I and
  PHY 131 General Physics I Laboratory
  PHY 132 General Physics II and
  PHY 133 General Physics II Laboratory

Required Courses ............................................................ 34 hrs
CHE 100T Transitions
CHE 201 General College Chemistry
CHE 202 General Chemistry and Qualitative Analysis
CHE 305 Analytical Chemistry
CHE 312 Organic Chemistry I
CHE 320 Organic Chemistry II
CHE 325  Organic Chemistry II Laboratory
CHE 403  Basic Physical Chemistry I
CSC 235  Programming in C++

Required Limited Electives ........................................... 10 hrs
ARC 335  Forensic Archaeology
CHE 330  Basic Biochemistry
CHE 352  Basic Chemical Instrumentation

Criminal Justice Minor\(^2\) ............................................... 21 hrs
CRI 220, 333, and 346 are required selections.

Unrestricted Electives .................................................. 11-14 hrs

Total Curriculum Requirements .................................... 120 hrs
\(^1\)Required for major if not taken as a University Studies elective.
\(^2\)CSC 232 or EGR 140 may be substituted.
\(^3\)A second major in Criminal Justice can substitute for the minor.

MAJOR:
Chemistry/Polymer and Materials Science Track

Bachelor of Science/Bachelor of Arts Degree
CIP 40.0501

University Studies Requirements ......................... 38-44 hrs
(See Academic Degrees and Programs.)

University Studies selections must include:
*Scientific Inquiry, Methodologies, and Quantitative Skills
MAT 250  Calculus and Analytic Geometry I\(^1\)
PHY 235  Mechanics, Heat and Wave Motion\(^1\)
PHY 236  Mechanics, Heat and Wave Motion Laboratory\(^1\)
PHY 255  Electricity, Magnetism and Light\(^1\)
PHY 256  Electricity, Magnetism and Light Laboratory\(^1\)

Required Courses ......................................................... 51 hrs
CHE 100T  Transitions
CHE 201  General College Chemistry
CHE 202  General Chemistry and Qualitative Analysis
CHE 305  Analytical Chemistry
CHE 312  Organic Chemistry I
CHE 320  Organic Chemistry II
CHE 352  Basic Chemical Instrumentation
CHE 503  Industrial Chemistry
CHE 576  Polymer Chemistry
CSC 235  Programming in C++
EGR 240  Thermodynamics I
EGR 375  Materials Science
MAT 308  Calculus and Analytic Geometry II
PHY 370  Introduction to Modern Physics

Required Limited Electives ........................................... 3 hrs
CHE 488  Cooperative Education/Internship
or
CHE 495  Senior Research

Required Minor\(^3\) ................................................. 11-21 hrs

Unrestricted Electives ................................................. 1-17 hrs

Total Curriculum Requirements ............................... 120 hrs
\(^1\)Required for major if not taken as a University Studies elective.
\(^2\)CSC 232 or EGR 140 may be substituted.
\(^3\)PHY 235, 236, 255, and 256 count toward a physics minor, with 11 additional hours remaining; otherwise, 21 hours are required to complete a minor.
MAJOR: Chemistry/Pre-Pharmacy Track

Bachelor of Science/Bachelor of Arts Degree
CIP 40.0501

University Studies Requirements ................................. 41-44 hrs
(See Academic Degrees and Programs.)

University Studies selections must include:
• Scientific Inquiry, Methodologies, and Quantitative Skills
  MAT 250 Calculus and Analytic Geometry I\(^1\)
  PHY 130 General Physics I\(^1\)
  PHY 131 General Physics I Laboratory\(^2\)
  PHY 132 General Physics II\(^1\)
  PHY 133 General Physics II Laboratory\(^2\)
• Social and Self-Awareness and Responsible Citizenship
  ECO 231 Principles of Microeconomics

Required Courses .................................................................. 46 hrs
CHE 100T Transitions
CHE 201 General College Chemistry
CHE 202 General Chemistry and Qualitative Analysis
CHE 305 Analytical Chemistry
CHE 312 Organic Chemistry I
CHE 320 Organic Chemistry II
CHE 325 Organic Chemistry II Laboratory
CHE 330 Basic Biochemistry
CHE 352 Basic Chemical Instrumentation
CHE 403 Basic Physical Chemistry I
CSC 235 Programming in C++\(^3\)
MAT 135 Introduction to Probability and Statistics

Required Minor\(^4\) .......................................................... 21 hrs

Unrestricted Electives ...................................................... 9-12 hrs

Total Curriculum Requirements ................................... 120 hrs
\(^1\)Colleges of pharmacy will have somewhat different requirements from those listed above. The curriculum can be modified to meet the requirements of most professional programs.
\(^2\)Required for major if not taken as a University Studies elective.
\(^3\)CSC 232 or EGR 140 may be substituted.
\(^4\)Biology minor is strongly recommended.

MAJOR: Chemistry/Pre-MBA Track

Bachelor of Science/Bachelor of Arts Degree
CIP 40.0501

University Studies Requirements ................................. 41-44 hrs
(See Academic Degrees and Programs.)

University Studies selections must include:
• Scientific Inquiry, Methodologies, and Quantitative Skills
  MAT 250 Calculus and Analytic Geometry I\(^1\)
  PHY 130 General Physics I\(^1\)
  PHY 131 General Physics I Laboratory\(^1\)
  PHY 132 General Physics II\(^1\)
  PHY 133 General Physics II Laboratory\(^1\)
• Social and Self-Awareness and Responsible Citizenship
  ECO 230 Principles of Macroeconomics\(^1\)
**Required Courses** ............................................................ 35 hrs
CHE 100T Transitions
CHE 201 General College Chemistry
CHE 202 General Chemistry and Qualitative Analysis
CHE 305 Analytical Chemistry
CHE 312 Organic Chemistry I
CHE 320 Organic Chemistry II
CHE 352 Basic Chemical Instrumentation
CHE 403 Basic Physical Chemistry
CSC 235 Programming in C++

**Required Business Courses/Minor** .................................... 24 hrs
ACC 200 Principles of Financial Accounting
ACC 201 Principles of Managerial Accounting
BUS 355 Information Systems and Decision Making
CIS 443 Business Statistics III
ECO 231 Principles of Microeconomics
FIN 330 Principles of Finance
MGT 350 Fundamentals of Management
MKT 360 Principles of Marketing

**Unrestricted Electives** .................................................... 17-20 hrs

**Total Curriculum Requirements** ...................................... 120 hrs
1Required for major if not taken as a University Studies elective.
2CSC 232 or EGR 140 may be substituted.
3Even though this program exceeds Murray State University’s requirements for a business administration minor, for a business administration minor to appear on a transcript, a minor must be declared, and all residential and graduation requirements must be met.

**Chemistry Minor** ............................................................ 21 hrs
CHE 201, 202 and electives selected from the following chemistry courses: 305, 312, 320, 325, 352, 400, 401, 403, 410, 420, 488, 495, and 330 or 530, but not both. A maximum of three hours may be counted from CHE 488. At least 21 hours is required. Six hours must be 300-level or above courses completed at Murray State University.

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**Graduate Programs**

Graduate Coordinator - Wafaa Fawzy

The Department of Chemistry offers the M.S. in Chemistry which is designed to prepare students for additional graduate work, as well as for immediate employment in industry or community colleges. Both thesis and non-thesis requirements are offered.

**Master of Science in Chemistry**

CIP 40.0501

**Requirements for Admission**

Applicants must meet the Murray State University requirements (see Graduate Admissions). Additional information regarding unconditional and conditional admission is given below.

**Unconditional**

To qualify for unconditional admission, an applicant must have:
1. an undergraduate degree in chemistry;
2. an overall undergraduate GPA of 3.0/4.0 or higher;
3. minimum GRE scores of: 140 verbal, 150 quantitative, 2.5 analytical writing;
4. for international students, minimum scores of: TOEFL 527, iBT TOEFL 71, with no band less than 16, or IELTS 6.0 with no band less than 5.0.

If the undergraduate degree does not conform to an ACS-certified program, students may be required to correct any deficiency in their undergraduate preparation.

**Conditional**

In exceptional cases (such as extensive work or research experience), students falling slightly below one of the unconditional admission benchmarks may still be considered for conditional admission. Applicants with TOEFL scores between 500 and 526 may be admitted on a conditional basis, but their proficiency in English will be further evaluated upon their arrival on campus, and they may be required to undertake additional study of English prior to beginning graduate work in chemistry.
THESIS REQUIREMENTS

Total Course Requirements ............................................. 30 hours
CHE 601 Seminar\(^1\)
CHE 602 Seminar\(^3\)
CHE 609 Advanced Inorganic Chemistry I
CHE 617 Advanced Organic Chemistry
CHE 681 Advanced Physical Chemistry

Research and Other Requirements
CHE 698-699PT Thesis Research
600-level courses (13 hrs)
(Up to six hours may be selected from courses other than CHE.)
\(^1\)Each student is required to prepare and present one seminar based on a thorough search of the chemical literature and one based on the student’s thesis research.

Other Degree Requirements
- Successful completion of an advanced instrumental analysis course (CHE 619 or equivalent).
- Submission and defense of a satisfactory thesis.

NON-THESIS REQUIREMENTS

Total Course Requirements ............................................. 36 hours\(^1\)
CHE 601 Seminar\(^2\)
CHE 602 Seminar\(^2\)
CHE 609 Advanced Inorganic Chemistry I
CHE 617 Advanced Organic Chemistry
CHE 681 Advanced Physical Chemistry
600-level courses (22 hrs)
(Up to nine hours may be selected from courses other than CHE.)
\(^2\)CHE 691, 692, and 693 will not count toward completion of this degree.
\(^3\)Each student is required to prepare and present two seminars based on a thorough search of the chemical literature.

Other Degree Requirements
- Successful completion of an advanced instrumental analysis course (CHE 619 or equivalent).
- CHE 600-level electives to total 36 hours.

Master of Science in Chemical Manufacturing Management

CIP 41.0301

Requirements for Admission
Applicants must meet the Murray State University requirements (see Graduate Admissions). Additional information regarding unconditional and conditional admission is given below.

Unconditional
To qualify for unconditional admission, an applicant must have an overall grade point average of 3.0 on a 4.0 scale in a chemistry-related field.

Conditional
Requirements for conditional admission are the same as MSU requirements.

Total Course Requirements ............................................. 30 hours\(^1\)

Core Courses ............................................................ 18 hours
Six courses chosen from the following:
CET 682 Industrial Ecology
CHE 600 Chemistry of Fuels\(^1\)
CHE 603 Industrial Chemistry
CHE 617 Advanced Organic Chemistry
CHE 627 Chemical Separations
CHE 676 Polymer Chemistry
IET 684 Engineering Economic Analysis
IET 691 Industrial Operations
IET 693 Systems Management Technology
Other Course Requirements ........................................... 12 hours

*Four additional elective courses chosen from the list of core courses and/or from the following*:

- CHE 609 Advanced Inorganic Chemistry I
- CHE 610 Chemical Thermodynamics
- CHE 613 Environmental Chemistry
- CHE 619 Instrumental Analysis
- CHE 628 Mass Spectrometry
- CHE 698 Thesis Research
- IET 644 Graduate Cooperative Education
- IET 679 Technical Writings
- IET 687 Quality Control
- IET 695 Industrial Supervision

1 A minimum of four CHE courses from core and elective courses is required.
2 Other elective courses may be approved by the graduate coordinator.
3 Completion and defense of thesis required. The thesis must adhere to the requirements provided in Murray State’s *Guidelines for the Preparation of the Master’s Thesis.*

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**Master of Arts in Education Secondary Teacher Leader with Chemistry Concentration**

CIP 13.1205

The Department of Chemistry provides instruction in support of the M.A.Ed. in Secondary Teacher Leader with a concentration in chemistry. Prospective students should contact the graduate coordinator in the College of Education and Human Services for details on advising and graduate program design.

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**Department of Geosciences**

334 Blackburn Science Building

270-809-2591

**Chair:** George Kipphut. **Faculty:** Casey, Cetin, El-Masri, Hong, Kipphut, Ortmann, Stinchcomb, Wesler, Zhang.

An area in geoscience with tracks in earth science, earth science teacher certification, environmental geology, geoarchaeology, and geographic information science are provided by the department faculty. Minors are offered in anthropology, archaeology, earth science, environmental geology, and geographic information science. An M.S. in Geosciences may also be earned.

In addition to the more traditional curricula, geosciences students have access to the Murray State Archaeology Lab, a summer field archaeology school, and the Mid-America Remote sensing Center (MARC), a core entity in the Murray State University Watershed Studies Institute (WSI).

Geosciences majors are encouraged to participate in internships and cooperative education experiences. Graduates have outstanding opportunities for employment as archaeologists, planners, cartographers, environmental geologists, remote sensing/GIS professionals, and other mapping science positions in business, government, and education.

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**AREA:**

**Geoscience/Earth Science Track**

**Bachelor of Science Degree**

CIP 40.0601

**University Studies Requirements** ........................................... 38-43 hrs

*(See Academic Degrees and Programs.)*

**Required Courses** ............................................................... 46 hrs

- ARC 150 Introduction to Archaeology
- AST 115 Introductory Astronomy
- AST 116 Introductory Astronomy Laboratory
- GSC 100T Transitions
- GSC 101 The Earth and the Environment
- GSC 102 Earth through Time
- GSC 110 World Geography
- GSC 125 Weather and Climate
- GSC 202 Introduction to Geographic Information Sciences
GSC 301 Understanding Scientific Communication
GSC 303 Introduction to Water Science
GSC 305 Introduction to Cartography
GSC 312 Introduction to Remote Sensing
GSC 336 Principles of Geomorphology
GSC 339 Field Geology
or
GSC 350 Field Techniques in Geosciences

Required Limited Electives................................................. 9-10 hrs
Choose from the following approved electives:
BIO 101 Biological Concepts
BIO 112 Field Biology
CHE 105 Introductory Chemistry
CHE 201 General College Chemistry
GSC 210 Hydrology
GSC 306 Landscapes of the National Parks
GSC 310 Rock and Mineral Resources
GSC 314 Sediments and Soils
GSC 330 Economic Geography
GSC 390 Geoarchaeology
GSC 424 Conservation and Environmental Geosciences
GSC 489 Cooperative Education/Internship
GSC 507 Land Use Planning
GSC 512 Remote Sensing
GSC 521 Geographic Information Systems
GSC 522 Digital Cartography
GSC 562 Hydrogeology
GSC 591 Special Problems
GSC 592 Special Problems
GSC 593 Special Problems
PHY 235 Mechanics, Heat and Wave Motion
PHY 236 Mechanics, Heat and Wave Motion Laboratory

Collateral requirement .................................................. 8 hrs
MAT 150 (or above)
CSC 101 or CSC 199

Unrestricted Electives..................................................... 13-19 hrs

Total Curriculum Requirements ...................................... 120 hrs
1Will count towards University Studies Global Awareness, Cultural Diversity, and the World's Artistic Tradition requirements.
2Will count towards University Studies Scientific Inquiry, Methodologies, and Quantitative Skills requirements.
3This is a University Studies electives writing-intensive or technology-intensive course.

AREA:
Geoscience/Earth Science Secondary Certification Track (Grades 8-12)

Bachelor of Science Degree
CIP 40.0601

University Studies Requirements .................................. 44 hrs
(See Academic Degrees and Programs.)

University Studies selections must include:

•Scientific Inquiry, Methodologies, and Quantitative Skills
  GSC 101 The Earth and the Environment
  GSC 102 Earth through Time
  MAT 150 Algebra and Trigonometry

•Global Awareness, Cultural Diversity and the World's Artistic Traditions
  GSC 110 World Geography

•Social and Self-Awareness and Responsible Citizenship
  EDP 260 Psychology of Human Development
University Studies Electives

ARC 150 Introduction to Archaeology
CSC 101 Introduction to Problem Solving Using Computers
EDU 103 Issues and Practices of American Education

Note: Certification requires a grade of B or better in one English composition course and a B or better in a University Studies math course, public speaking, and EDU 103 or equivalent course. Additional requirements for admission to teacher education and student teaching must be met. See advisor and/or Office of Teacher Education Services for details.

Required Courses ............................................................ 32 hrs
AST 115 Introductory Astronomy
AST 116 Introductory Astronomy Laboratory
GSC 100T Transitions
GSC 125 Weather and Climate
GSC 202 Introduction to Geographic Information Sciences
GSC 301 Understanding Scientific Communication
GSC 303 Introduction to Water Science
GSC 305 Introduction to Cartography
GSC 312 Introduction to Remote Sensing
GSC 336 Principles of Geomorphology
GSC 339 Field Geology
or
GSC 350 Field Techniques in Geosciences

Required Limited Electives.................................................. 12 hrs
Select upper-level courses from the list of approved geology electives given under the track in environmental geology, below.

The National Science Teachers Association (NSTA) recommends a minimum of one course from each of the following three areas, with total of recommended supplemental science hours to include no fewer than 16 semester hours.

A. Biology
BIO 101 Biological Concepts
BIO 112 Field Biology
BIO 221 Zoology: Animal Form and Function
BIO 222 Botany: Plant Form and Function

B. Chemistry
CHE 101 Consumer Chemistry
CHE 105 Introductory Chemistry
CHE 201 General College Chemistry
CHE 202 General Chemistry and Qualitative Analysis

C. Physics
PHY 235 Mechanics, Heat and Wave Motion
PHY 236 Mechanics, Heat and Wave Motion Laboratory
PHY 255 Electricity, Magnetism and Light
PHY 256 Electricity, Magnetism and Light Laboratory

Required for Secondary Certification ...................... 32 hrs
EDU 303 Strategies of Teaching
EDU 403 Structures and Foundations of Education
EDU 405 Evaluation and Measurement in Education
SEC 420 Practicum in Secondary Schools
SEC 421 Student Teaching in the Secondary School
SEC 422 Extended Practicum
SED 300 Educating Students with Disabilities

Total Curriculum Requirements ................................. 120 hrs

1Must be taken together and two semesters before student teaching.
2Must be taken one semester before student teaching.
The teaching specialization in earth science is a path to secondary certification in earth science designed to accompany certification in another science content area (biology/chemistry/physics). All College of Education and Human Services secondary certification course requirements must be met. **Note:** Even though this program exceeds Murray State University’s requirements for an earth science minor, in order for an earth science minor to appear on a transcript, a minor must be declared, and all residential and graduation requirements must be met.

Requirements for teacher certification are established by the Kentucky Education Professional Standards Board. Students are cautioned that changes in these requirements may occur. Therefore, for the most current information, students should check with an advisor in the College of Education and Human Services.

### Earth Science Teaching Specialization

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<tr>
<th>Course Code</th>
<th>Course Title</th>
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<td>AST 115</td>
<td>Introductory Astronomy</td>
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<td>AST 116</td>
<td>Introductory Astronomy Laboratory</td>
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<tr>
<td>GSC 101</td>
<td>The Earth and the Environment</td>
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<td>GSC 102</td>
<td>Earth through Time</td>
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<td>GSC 125</td>
<td>Weather and Climate</td>
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<td>GSC 202</td>
<td>Introduction to Geographic Information Sciences</td>
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<td>GSC 300T</td>
<td>Transitions</td>
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<tr>
<td>GSC 302</td>
<td>Earth through Time</td>
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<tr>
<td>GSC 303</td>
<td>Introduction to Water Science</td>
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<tr>
<td>GSC 336</td>
<td>Principles of Geomorphology</td>
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<td>GSC 339</td>
<td>Field Geology</td>
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<tr>
<td>GSC 350</td>
<td>Field Techniques in Geosciences</td>
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</tbody>
</table>

**AREA:**

**Geoscience/Environmental Geology Track**

Bachelor of Science Degree  
CIP 40.0601

### University Studies Requirements

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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<tbody>
<tr>
<td>ARC 300</td>
<td>Archaeology Method and Theory</td>
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<td>ARC 302</td>
<td>Archaeological Field Work I</td>
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<td>ARC 304</td>
<td>Archaeology Laboratory Methods</td>
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<td>ARC 390</td>
<td>Geoarchaeology</td>
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<td>CET 280</td>
<td>Plane Surveying</td>
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<td>GSC 200</td>
<td>Introduction to Oceanography</td>
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<td>GSC 303</td>
<td>Introduction to Water Science</td>
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<td>GSC 306</td>
<td>Landscapes of the National Parks</td>
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<td>GSC 330</td>
<td>Economic Geography</td>
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<td>GSC 339</td>
<td>Field Geology</td>
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<td>GSC 350</td>
<td>Field Techniques in Geosciences</td>
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<td>GSC 388</td>
<td>International Experience in the Geosciences</td>
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<td>GSC 424</td>
<td>Conservation and Environmental Geosciences</td>
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<tr>
<td>GSC 489</td>
<td>Cooperative Education/Internship</td>
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### Required Courses

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<tr>
<th>Course Code</th>
<th>Course Title</th>
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<tbody>
<tr>
<td>ARC 150</td>
<td>Introduction to Archaeology 1</td>
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<tr>
<td>GSC 101</td>
<td>The Earth and the Environment 2</td>
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<tr>
<td>GSC 102</td>
<td>Earth through Time 2</td>
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<tr>
<td>GSC 110</td>
<td>World Geography 1</td>
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<td>GSC 202</td>
<td>Introduction to Geographic Information Sciences</td>
</tr>
<tr>
<td>GSC 210</td>
<td>Hydrology</td>
</tr>
<tr>
<td>GSC 301</td>
<td>Understanding Scientific Communication</td>
</tr>
<tr>
<td>GSC 305</td>
<td>Introduction to Cartography</td>
</tr>
<tr>
<td>GSC 310</td>
<td>Rock and Mineral Resources</td>
</tr>
<tr>
<td>GSC 312</td>
<td>Introduction to Remote Sensing</td>
</tr>
<tr>
<td>GSC 314</td>
<td>Sediments and Soils</td>
</tr>
<tr>
<td>GSC 336</td>
<td>Principles of Geomorphology</td>
</tr>
<tr>
<td>GSC 562</td>
<td>Hydrogeology</td>
</tr>
</tbody>
</table>

### Required Limited Electives

Choose from the following approved electives:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>ARC 300</td>
<td>Archaeology Method and Theory</td>
</tr>
<tr>
<td>ARC 302</td>
<td>Archaeological Field Work I</td>
</tr>
<tr>
<td>ARC 304</td>
<td>Archaeology Laboratory Methods</td>
</tr>
<tr>
<td>ARC 390</td>
<td>Geoarchaeology</td>
</tr>
<tr>
<td>CET 280</td>
<td>Plane Surveying</td>
</tr>
<tr>
<td>GSC 200</td>
<td>Introduction to Oceanography</td>
</tr>
<tr>
<td>GSC 303</td>
<td>Introduction to Water Science</td>
</tr>
<tr>
<td>GSC 306</td>
<td>Landscapes of the National Parks</td>
</tr>
<tr>
<td>GSC 330</td>
<td>Economic Geography</td>
</tr>
<tr>
<td>GSC 339</td>
<td>Field Geology</td>
</tr>
<tr>
<td>GSC 350</td>
<td>Field Techniques in Geosciences</td>
</tr>
<tr>
<td>GSC 388</td>
<td>International Experience in the Geosciences</td>
</tr>
<tr>
<td>GSC 424</td>
<td>Conservation and Environmental Geosciences</td>
</tr>
<tr>
<td>GSC 489</td>
<td>Cooperative Education/Internship</td>
</tr>
</tbody>
</table>
GSC 507  Land Use Planning
GSC 512  Remote Sensing
GSC 521  Geographic Information Systems
GSC 522  Digital Cartography
GSC 534  Invertebrate Paleontology
GSC 542  Watershed Ecology
GSC 591  Special Problems
GSC 592  Special Problems
GSC 593  Special Problems

Collateral requirement ...................................................... 8 hrs
MAT 150 or above
CSC 101 or CSC 199

Unrestricted Electives ..................................................... 14-20 hrs
Board of Registration for Professional Geologists recommends the following courses to enhance performance on the Professional Geologist Examination.

CHE 105  Introductory Chemistry
or
CHE 201  General College Chemistry
CHE 202  General Chemistry and Qualitative Analysis
CSC 101  Introduction to Problem Solving Using Computers
(or other computer science course)
or
PHY 130  General Physics I

Total Curriculum Requirements ........................................ 120 hrs
1Will count towards University Studies Global Awareness, Cultural Diversity, and the World's Artistic Tradition requirements.
2Will count towards University Studies Scientific Inquiry, Methodologies, and Quantitative Skills requirements.
3This is a University Studies electives writing-intensive or technology-intensive course.

AREA:
Geoscience/Geoarchaeology Track

Bachelor of Science Degree
CIP 40.0601

University Studies Requirements ...................................... 38-43 hrs
(See Academic Degrees and Programs.)

Recommended University Studies selection:
*Social and Self-Awareness and Responsible Citizenship
ANT 140  Introduction to Cultural Anthropology

Required Courses ............................................................. 43 hrs
ARC 150  Introduction to Archaeology1
ARC 300  Archaeological Method and Theory
ARC 304  Archaeological Laboratory Methods
ARC 330  North American Archaeology
ARC 390  Geoarchaeology
GSC 100T  Transitions
GSC 101  The Earth and the Environment2
GSC 110  World Geography1
GSC 202  Introduction to Geographic Information Sciences
GSC 301  Understanding Scientific Communication
GSC 305  Introduction to Cartography
GSC 312  Introduction to Remote Sensing
GSC 336  Principles of Geomorphology

Five credit hours chosen from the following:
ARC 302  Archaeological Field Work I
ARC 402  Archaeological Field Work II
ARC 510  Advanced Archaeological Field Work
Required Limited Electives ............................................ 10-11 hrs
Choose from the following approved electives:
ANT 311 Anthropology of Complex Societies
ANT 325 Biological Anthropology
ANT 329 North American Indians
ARC 314 Sediments and Soils
ARC 315 Special Topics in Archaeology
ARC 320 Human Ecology
ARC 321 Ancient Civilizations
ARC 335 Forensic Archaeology
ARC 340 Archaeology of Africa
ARC 350 Public Archaeology
ARC 357 Lithic Analyses
ARC 360 Historical Archaeology
ARC 370 Archaeology of the Eastern Woodlands
ARC 385 Archaeology of Eastern Asia
ARC 395 Archaeology of Religion
ARC 402 Archaeological Field Work II
ARC 425 Advanced Archaeological Laboratory Methods
ARC 488 Cooperative Education/Internship
ARC 489 Cooperative Education/Internship
ARC 500 Directed Studies
ARC 510 Advanced Archaeological Field Work
CET 280 Plane Surveying
GSC 306 Landscapes of the National Parks
GSC 310 Rock and Mineral Resources
GSC 350 Field Techniques in Geosciences
GSC 388 International Experience in the Geosciences
GSC 521 Geographic Information Systems

Collateral requirement ...................................................... 8 hrs
MAT 150 (or above)
CSC 101 or CSC 199

Unrestricted Electives .................................................... 15-21 hrs

Total Curriculum Requirements ......................................... 120 hrs

1 Will count towards University Studies Global Awareness, Cultural Diversity, and the World's Artistic Tradition requirements.
2 Will count towards University Studies Scientific Inquiry, Methodologies, and Quantitative Skills requirements.
3 This is a University Studies electives writing-intensive or technology-intensive course.

AREA:
Geoscience/Geographic Information Science Track

Bachelor of Science Degree
CIP 40.0601

University Studies Requirements ..................................... 38-43 hrs
(See Academic Degrees and Programs.)

Required Courses .......................................................... 43 hrs
ARC 150 Introduction to Archaeology
GSC 100T Transitions
GSC 101 The Earth and the Environment
GSC 110 World Geography
GSC 125 Weather and Climate
GSC 202 Introduction to Geographic Information Sciences
GSC 301 Understanding Scientific Communication
GSC 305 Introduction to Cartography
GSC 312 Introduction to Remote Sensing
GSC 330 Economic Geography
GSC 336 Principles of Geomorphology
GSC 512 Remote Sensing
GSC 521 Geographic Information Systems
Required Limited Electives .......................................... 10-11 hrs
Choose from the following approved electives:
GSC 210 Hydrology
GSC 303 Introduction to Water Science
GSC 306 Landscapes of the National Park
GSC 310 Rock and Mineral Resources
GSC 314 Sediments and Soils
GSC 350 Field Techniques in Geosciences
GSC 390 Geoarchaeology
GSC 424 Conservation and Environmental Geosciences
GSC 488 Cooperative Education/Internship
GSC 489 Cooperative Education/Internship
GSC 507 Land Use Planning
GSC 562 Hydrogeology
GSC 591 Special Problems
GSC 592 Special Problems
GSC 593 Special Problems

Collateral requirement .................................................. 8 hrs
MAT 150\(^1\) (or above)
CSC 101\(^2\) or CSC 199\(^3\)

Unrestricted Electives .................................................. 15-21 hrs

Total Curriculum Requirements .................................... 120 hrs
\(^1\)Will count towards University Studies Scientific Inquiry, Methodologies, and Quantitative Skills requirements.
\(^2\)Will count towards University Studies Global Awareness, Cultural Diversity, and the World’s Artistic Tradition requirements.
\(^3\)This is a University Studies electives writing-intensive or technology-intensive course.

Anthropology Minor .................................................... 21 hrs
Note: The Anthropology Minor is suspended at this time. No new students may declare this minor until further notice. Contact the department for further information. ANT 140, ANT 325, ARC 150, plus 12 hours of ANT 300-level or above electives. Electives may include ARC 325, 330, 340, and 385. Electives may substitute up to six hours selected from the following as approved by advisor: HIS 309, 354, 370, 451, SOC 337, 434. Six hours must be upper-level courses completed at Murray State University.

Archaeology Minor .................................................... 21 hrs
ARC 150, 300, 302, 304, 350, plus six hours of ARC electives 300-level or above. Six hours must be upper-level courses completed at Murray State University.

Earth Science Minor ................................................... 21 hrs
GSC 101, 102, 125, and 339 or 350. Six additional hours selected from the following: AST 115, 116; GSC 202, 210, 303, 310, 312, 336, 591, 592, 593. Six hours must be upper-level courses completed at Murray State University.

Environmental Geology Minor ..................................... 21 hrs
GSC 101, 102, 202, and three additional geology courses chosen with the advice and consent of the chair of the Department of Geosciences. Six hours must be upper-level courses completed at Murray State University.

Geographic Information Science Minor ....................... 21 hrs
GSC 110, 125, 202, 305, and seven hours of electives selected from the following: GSC 312, 350, 507, 512, 521, 522, 591, 592, 593. Six hours must be upper-level courses completed at Murray State University.

Social Science Minor .................................................. 24 hrs
Open only to majors in economics, geoscience, history, or political science who seek secondary certification in social studies. ECO 231, GSC 110, HIS 221, POL 140, SOC 133; and six hours of upper level courses (300 or above) from the social science disciplines with approval of advisor. Courses required for a major may not be counted toward the minor; substitutions must be from a social science discipline other than the major and be approved by the advisor; and requirements for certification for teaching secondary school social studies, grades 8 through 12 through the College of Education must also be met. Six hours must be upper-level courses completed at Murray State University.
CERTIFICATE: Geographic Information Science

The certificate in GIScience program is designed to provide students fundamental knowledge of geographic information science necessary for today’s diverse array of fields and disciplines. The certification program will provide students experience in data collection, data management methods and techniques, data visualization, data analysis and interpretation, and the principles and techniques to remote sensing. Student will gain experience using industry standard hardware and software to develop a variety of projects and explore sever GIScience applications.

CIP 45.0702

Total Course Requirements .................................................. 15 hours
GSC 202 Introduction to Geographic Information Science
GSC 512 Remote Sensing
GSC 521 Geographic Information Systems

One elective course from the following:
AGR 471 Applications in Precision Agriculture
CIS 307 Decision Support Technologies
CIS 317 Principles of Information Systems Analysis and Design
CSC 145 Introduction to Programming
CSC 232 Visual Basic Programming
CSC 310 Data Administration
CSC 345 Data Structures
GSC 305 Introduction to Cartography
GSC 507 Land Use Planning
GSC 522 Digital Cartography
GSC 570 Computer Applications in Geosciences
MKT 585 Integrated Business GIS

1 A grade of C or better must be earned in all courses.

Graduate Program

Graduate Coordinator - Kit Wesler

The Department of Geosciences offers a Master of Science degree that focuses upon applications of remote sensing, archaeological and geographic information technologies. Students are prepared for positions in the public and private sectors and study at the Ph.D. level. Geosciences is closely associated with the Mid-America Remote Sensing Center (MARC) where hardware and software related to remote sensing and geographic information science are located. Students also have the opportunity to conduct research through activities of the department’s Archaeology Laboratory. The student’s program is developed in consultation with the graduate coordinator.

Requirements for Admission

Applicants must meet the Murray State University requirements (see Graduate Admissions). The department requires that three letters of recommendation and GRE scores accompany application materials. A letter discussing reasons for the applicant’s interest in the program should also be forwarded. Additional requirements for unconditional and conditional admission are as follows.

Unconditional
To qualify for unconditional admission, an applicant must have an overall grade point average of 3.0 (on a 4.0 scale) in a geoscience (or related) field and a composite GRE score (V+Q) of 1,000 old scale or 300 new scale.

Conditional
Students admitted conditionally are admitted to full standing after completing (1) any remedial courses required by the graduate faculty and (2) one semester of graduate work with an overall grade point average of 3.0 or above.

Master of Science in Geosciences

CIP 40.0699

THESIS REQUIREMENTS

Total Course Requirements .................................................. 30 hours
GSC 612 Remote Sensing
GSC 619 Seminar in Research Techniques
GSC 621 Geographic Information Systems
GSC 640 Advanced Remote Sensing
GSC 680 Advanced Geographic Information Systems
Science, Engineering and Technology

GSC 696 Understanding Scientific Communication
GSC courses at 600-level (3 hrs)
GSC or related courses at 600-level (2 hrs)
GSC 698-699 Thesis Research

Other Degree Requirements
• Proficiency in quantitative methods through MAT 665.
• Oral defense of thesis.

NON-THESIS REQUIREMENTS

Total Course Requirements ............................................ 33 hours
Same as above with the following substitution for thesis:
GSC courses, at 600-level ........................................ increase to 6 hrs
GSC or related courses at 600-level............................ increase to 8 hrs

Other Degree Requirements
• Proficiency in quantitative methods through MAT 665.
• Written and oral comprehensive examinations.

Institute of Engineering
263A Collins Center
270-809-3392

Chair: Danny Claiborne. Faculty: Ashburn, Bahadir, Chitikeshi, Claiborne, Crofton, Ford, Giltner, Hardin, Hereford, Hildebrant, Kellie, Kemp, Kobraei, Leedy, Okuda, Ottway, Palmer, Payne, Perry, Ridley, Rogers, Schneiderman, Siebold, Thiede, Tubbs, Yarali, Zirbel.

The Institute of Engineering offers undergraduate programs in engineering, engineering technology, industrial technology and design, physics and telecommunications systems management. It also offers a graduate program in applied engineering and technology management.

Murray State University offers a Bachelor of Science in Engineering (B.S.E.) as a major in engineering physics. The Engineering Physics program has four tracks in mechanical engineering, electrical engineering, biomedical engineering and advanced physics. In all of these areas, students will learn to use advanced analytical techniques in solving engineering problems, and will develop the applied background to attack new engineering challenges creatively.

Murray State’s Engineering Physics degree is an engineering program accredited by the Engineering Accreditation Commission of the ABET (EAC/ABET). This accreditation will place a student on the pathway to become a licensed engineer in Kentucky and throughout the country. Recognition by this organization has been earned by fewer than 20 Engineering Physics programs nationwide.

The Institute of Engineering offers strong undergraduate programs in engineering technology, which are: architectural engineering technology, civil engineering technology, construction engineering technology, electromechanical engineering technology and environmental engineering technology. Graduates from these programs are prepared to succeed in a modern industrial environment.

The Industrial Technology and Design program at MSU offers tracks in engineering graphics and design, interior design and manufacturing technology. Graduates from these programs are able to apply product and process design for products related to manufacturing or architectural design.

Students interested in physics have two attractive degree options. The traditional physics major is accompanied by a flexible area in applied physics, where a student can design curricular choices to fit their chosen professional goals. These degrees are well-suited to students desiring teaching certification, or intending to pursue graduate degrees or corporate/industrial research positions.

Kentucky’s Program of Distinction in Telecommunications Systems Management (TSM) is also offered by the Institute of Engineering. The TSM program is actually an interdisciplinary program between the Jesse D. Jones College of Science, Engineering and Technology and the Arthur J. Bauernfeind College of Business. The TSM program prepares graduates to work on cutting-edge information technologies related to wireless technology, security, and network administration while also applying concepts toward business decisions and critical strategic planning as it relates to telecommunications systems.

Engineering Accreditation
The B.S.E. in Engineering Physics (including all tracks in biomedical, electrical, mechanical and advanced physics) is an engineering program accredited by the Engineering Accreditation Commission of the ABET (EAC/ABET), 415 415 North Charles Street, Baltimore, MD 21201. Phone (410) 347-7700. This accreditation will place a student on the pathway to become a licensed engineer in Kentucky and throughout the country.

Engineering Technology Accreditation
The Engineering Technology Accreditation Commission of ABET (ETAC/ABET) accredits Murray State programs in civil and construction engineering technology. The Civil Engineering Technology/General Track and the Civil Engineering Technology/Construction Track programs are accredited by the Engineering Technology Accreditation Commission of ABET, 415 North Charles Street, Baltimore, MD 21201. Phone (410) 347-7700.
AREA: Engineering Physics

Bachelor of Science in Engineering Degree
CIP 14.1201

ACCREDITED BY: Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology (EAC/ABET)

University Studies Requirements .................................. 38-43 hrs
(See Academic Degrees and Programs.)

University Studies selections must include:
  • Social and Self-Awareness and Responsible Citizenship
    ECO 231 Principles of Microeconomics
    or
    HON 232 Honors Seminar in Economics

Core Courses .............................................................. 52 hrs
CHE 201 General College Chemistry\textsuperscript{1,3}
EGR 100T Transitions
EGR 101 Introduction to Engineering\textsuperscript{a}
EGR 140 Introduction to Computing Applications in Science and Engineering
EGR 240 Thermodynamics I
EGR 259 Statics
EGR 264 Linear Circuits I
EGR 330 Dynamics
EGR 363 Signals and Systems
EGR 375 Materials Science
EGR 390 Engineering Measurements
EGR 460 Electricity and Magnetism I
EGR 498 Senior Engineering Design I
EGR 499 Senior Engineering Design II
MAT 250 Calculus and Analytic Geometry \textsuperscript{2,3}
MAT 308 Calculus and Analytic Geometry II\textsuperscript{2,3}
MAT 309 Calculus and Analytic Geometry III\textsuperscript{2,3}
MAT 338 Ordinary Differential Equations\textsuperscript{3}
PHY 235 Mechanics, Heat and Wave Motion\textsuperscript{2}
PHY 236 Mechanics, Heat and Wave Motion Laboratory\textsuperscript{2}
PHY 255 Electricity, Magnetism and Light
PHY 256 Electricity, Magnetism and Light Laboratory
PHY 370 Introduction to Modern Physics
PHY 470 Optics

Advanced Physics Track
Completion of nine hours of 300-level and above PHY courses beyond the core course requirements.

Biomedical Engineering Track\textsuperscript{5}
BIO 115 Cellular Basis of Life
BIO 322 Animal Physiology
CHE 202 General Chemistry and Qualitative Analysis
CHE 312 Organic Chemistry I
EGR 310 Fundamentals of Biomedical Engineering

Electrical Engineering Track
Choose four of the following courses:
EGR 360 Electric Machines
EGR 365 Linear Circuits II
EGR 366 Analog Electronics I
EGR 376 Computational Analysis in Engineering
EGR 378 Logic Design I
EGR 461 Electricity and Magnetism II
EGR 463 Power Systems
EGR 466 Power Electronics
EGR 468 Digital Signal Processing
Mechanical Engineering Track

Choose four of the following courses:

- EGR 340 Wave Analysis of Dynamic Systems
- EGR 342 Thermodynamics II
- EGR 344 Fluid Mechanics
- EGR 346 Heat Transfer
- EGR 359 Mechanics of Materials
- EGR 459 Mechanical Design
- ITD 102 CAD Applications

Mathematics Depth Elective

Each student must complete a mathematics depth elective chosen from MAT 335, 440, 442, 450, 460, 508, 512, 513, 522, 523, 524, 525, 535, 538, 540, 541, 542, 545, 554, 570, or as approved by the department chair. Students with a Biomedical Engineering track must take MAT 135, 540, or 554 for this elective.

Technical Electives

Each student must complete 18 hours of technical electives. A minimum of 12 technical elective credit hours must be obtained from EGR courses. Completion of a track is encouraged but not required.

Unrestricted Elective

Total Curriculum Requirements

1This degree program has been approved by the Kentucky Education Professional Standards Board as a track for secondary education certification in physics. Students seeking certification via this Track must complete the Engineering Physics curriculum and the courses required for secondary certification as listed above. For current information, student should consult an advisor in the Department of Adolescent, Career and Special Education and with Teacher Education Services.

2These courses are required and also fulfill University Studies requirements.

3This course is considered a program corequisite and may be shared with a minor or second major.

4Previous credit for EGR 195 fulfills this requirement.

5Students completing the track in biomedical engineering and intending to seek admission to medical school are encouraged to complete the following: BIO 321, 333; CHE 320 and 325.

6Technical Electives must come from the courses listed in the areas of emphasis or EGR/PHY courses, 300-level and above, or as approved by department chair.

7A maximum of six technical elective credit hours may come from combinations of EGR/PHY 488, 489, 520, and EGR 388.

Engineering Science Minor

Pre-Engineering Curriculum (64 hrs)

- CHE 201 General College Chemistry
- CHE 202 General Chemistry and Qualitative Analysis
- EGR 140 Introduction to Computing Applications in Science and Engineering
- MAT 250 Calculus and Analytic Geometry I
- MAT 308 Calculus and Analytic Geometry II
- MAT 309 Calculus and Analytic Geometry III
- MAT 338 Ordinary Differential Equations
- PHY 235 Mechanics, Heat and Wave Motion
- PHY 236 Mechanics, Heat and Wave Motion Laboratory
- PHY 255 Electricity, Magnetism and Light
- PHY 256 Electricity, Magnetism and Light Laboratory

University Studies courses

Discipline-specific courses
MAJOR:  
Physics

Bachelor of Science/Bachelor of Arts Degree  
CIP 40.0801

University Studies Requirements ................................................. 38-44 hrs  
(See Academic Degrees and Programs.)

Note:  See required courses below before selecting Scientific Inquiry, Methodologies, and Quantitative Skills University Studies electives.

Required Courses .................................................................. 32 hrs
EGR 140  Introduction to Computing Applications in Science and Engineering  
EGR 240  Thermodynamics I  
EGR 390  Engineering Measurements  
PHY 100T  Transitions  
PHY 235  Mechanics, Heat and Wave Motion  
PHY 236  Mechanics, Heat and Wave Motion Laboratory  
PHY 255  Electricity, Magnetism and Light  
PHY 256  Electricity, Magnetism and Light Laboratory  
PHY 460  Electricity and Magnetism I  
PHY 470  Optics  
PHY 530  Mechanics I  
PHY 580  Modern Physics I

Co-requirements for Major ......................................................... 6 hrs
CHE 201  General College Chemistry¹, ²  
CHE 202  General Chemistry and Qualitative Analysis¹, ²  
CSC 420  Numerical Analysis I  
or  
MAT 442  Introduction to Numerical Analysis²  
MAT 250  Calculus and Analytic Geometry I¹, ²  
MAT 308  Calculus and Analytic Geometry II¹, ²  
MAT 309  Calculus and Analytic Geometry III¹, ²  
MAT 338  Ordinary Differential Equations²

Required Limited Electives ......................................................... 3 hrs
PHY/EGR courses numbered 300 or above.

Required Minor ................................................................. 3-21 hrs²

Unrestricted Electives ................................................................. 14-20 hrs

Total Curriculum Requirements ............................................. 120 hrs

¹Fulfill University Studies requirements. Required for major if not taken as a University Studies requirement.  
²CHE 201 and 202 fulfill requirements for a minor in chemistry; MAT 250, 308, 309, 338, and 442 fulfill requirements for a minor in math.

MAJOR:  
Physics/Secondary Certification (Grades 8-12)

Bachelor of Science/Bachelor of Arts Degree  
CIP 40.0801

NOTE:  Requirements for teacher certification are established by the Kentucky Education Professional Standards Board. Students are cautioned that changes in these requirements may occur. For current information, student should check with an advisor in the Department of Adolescent, Career and Special Education and with Teacher Education Services.

University Studies Requirements ............................................ 38-44 hrs  
(See Academic Degrees and Programs.)

University Studies selections must include:  
• Social and Self-Awareness and Responsible Citizenship  
EDP 260  Psychology of Human Development

Note: Certification requires a grade of B or better in one English composition course and a B or better in a University Studies math course, public speaking, and EDU 103 or equivalent course. Additional requirements for admission to teacher education and student teaching must be met. See advisor and/or Office of Teacher Education Services for details.
### Required Courses ............................................................ 32 hrs

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>EGR 140</td>
<td>Introduction to Computing Applications in Science and Engineering</td>
</tr>
<tr>
<td>EGR 240</td>
<td>Thermodynamics I</td>
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<td>EGR 390</td>
<td>Engineering Measurements</td>
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<td>PHY 100T</td>
<td>Transitions</td>
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<td>PHY 236</td>
<td>Mechanics, Heat and Wave Motion Laboratory</td>
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<td>PHY 255</td>
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<td>PHY 256</td>
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<td>PHY 530</td>
<td>Mechanics I</td>
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<tr>
<td>PHY 580</td>
<td>Modern Physics I</td>
</tr>
</tbody>
</table>

### Co-requirements for Major ................................................... 6 hrs

<table>
<thead>
<tr>
<th>Course</th>
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<tbody>
<tr>
<td>CHE 201</td>
<td>General College Chemistry$^{1,2}$</td>
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<tr>
<td>CHE 202</td>
<td>General Chemistry and Qualitative Analysis$^{1,2}$</td>
</tr>
<tr>
<td>CSC 420</td>
<td>Numerical Analysis I</td>
</tr>
<tr>
<td>MAT 420</td>
<td>Introduction to Numerical Analysis$^2$</td>
</tr>
<tr>
<td>MAT 250</td>
<td>Calculus and Analytic Geometry I$^{1,2}$</td>
</tr>
<tr>
<td>MAT 308</td>
<td>Calculus and Analytic Geometry II$^{1,2}$</td>
</tr>
<tr>
<td>MAT 309</td>
<td>Calculus and Analytic Geometry III$^{1,2}$</td>
</tr>
<tr>
<td>MAT 338</td>
<td>Ordinary Differential Equations$^2$</td>
</tr>
</tbody>
</table>

### Required Limited Electives .................................................... 3 hrs

*PHY/EGR courses numbered 300-level or above.

### Required for Secondary Certification ........................................ 35 hrs

<table>
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<tr>
<th>Course</th>
<th>Title</th>
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<tbody>
<tr>
<td>EDU 103</td>
<td>Issues and Practices of American Education$^3$</td>
</tr>
<tr>
<td>EDU 303</td>
<td>Strategies of Teaching</td>
</tr>
<tr>
<td>EDU 403</td>
<td>Structures and Foundations of Education</td>
</tr>
<tr>
<td>EDU 405</td>
<td>Evaluation and Measurement in Education$^4$</td>
</tr>
<tr>
<td>SEC 420</td>
<td>Practicum in Secondary Schools$^4$</td>
</tr>
<tr>
<td>SEC 421</td>
<td>Student Teaching in the Secondary School</td>
</tr>
<tr>
<td>SEC 422</td>
<td>Extended Practicum$^5$</td>
</tr>
<tr>
<td>SED 300</td>
<td>Educating Students with Disabilities</td>
</tr>
</tbody>
</table>

### Required Minor .............................................................. 3-21 hrs$^2$

### Total Curriculum Requirements .............................................. 120-123 hrs

1. Fulfill University Studies requirements. Required for major if not taken as a University Studies requirement.
2. CHE 201 and 202 fulfill requirements for a minor in chemistry; MAT 250, 308, 309, 338 and 442 fulfill requirements for a minor in math.
3. With a grade of B or better.
4. EDU 405 and SEC 420 must be taken together and two semesters before student teaching.
5. Must be taken one semester before student teaching.

### Physics Teaching Specialization

The teaching specialization in physics is a path to secondary certification in physics, designed to accompany certification in another science content area. (All College of Education and Human Services secondary certification course requirements must be met.) **Note:** Even though this program exceeds Murray State University’s requirements for a physics minor, in order for a physics minor to appear on a transcript, a minor must be declared, and all residential and graduation requirements must be met.

Requirements for teacher certification are established by the Kentucky Education Professional Standards Board and changes in these requirements may occur. Students should check with an advisor in the College of Education and Human Services for the most current information.

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>AST 115</td>
<td>Introductory Astronomy</td>
</tr>
<tr>
<td>AST 116</td>
<td>Introductory Astronomy Laboratory</td>
</tr>
<tr>
<td>MAT 250</td>
<td>Calculus and Analytic Geometry I$^2$</td>
</tr>
<tr>
<td>MAT 308</td>
<td>Calculus and Analytic Geometry II$^2$</td>
</tr>
<tr>
<td>PHY 235</td>
<td>Mechanics, Heat and Wave Motion</td>
</tr>
<tr>
<td>PHY 236</td>
<td>Mechanics, Heat and Wave Motion Laboratory</td>
</tr>
<tr>
<td>PHY 255</td>
<td>Electricity, Magnetism and Light</td>
</tr>
<tr>
<td>PHY 256</td>
<td>Electricity, Magnetism and Light Laboratory</td>
</tr>
<tr>
<td>PHY 370</td>
<td>Introduction to Modern Physics</td>
</tr>
</tbody>
</table>
Required Limited Electives ................................................................. 9 hrs
PHY/EGR courses numbered 300-level or above.

Physics Teaching Specialization ..................................................... 36 hrs
1Corequisite of PHY 235.
2Corequisite of PHY 255.

AREA:
Applied Physics

Bachelor of Science/Bachelor of Arts Degree
CIP 40.0801

University Studies Requirements .............................................. 38-44 hrs
(See Academic Degrees and Programs.)
Note: See required courses below before selecting Scientific Inquiry, Methodologies, and Quantitative Skills University Studies electives.

Required Courses ................................................................. 33 hrs
EGR 140 Introduction to Computing Applications in Science and Engineering
EGR 240 Thermodynamics I
EGR 264 Linear Circuits I
PHY 100T Transitions
PHY 235 Mechanics, Heat and Wave Motion
PHY 236 Mechanics, Heat and Wave Motion Laboratory
PHY 255 Electricity, Magnetism and Light
PHY 256 Electricity, Magnetism and Light Laboratory
PHY 370 Introduction to Modern Physics
or
PHY 580 Modern Physics I
PHY 460 Electricity and Magnetism I
PHY 470 Optics
PHY 530 Mechanics I

Co-requisites for Area ......................................................... 6 hrs
CHE 201 General College Chemistry1, 2
CHE 202 General Chemistry and Qualitative Analysis1, 2
CSC 420 Numerical Analysis I
or
MAT 442 Introduction to Numerical Analysis2
MAT 250 Calculus and Analytic Geometry I1, 2
MAT 308 Calculus and Analytic Geometry II1, 2
MAT 309 Calculus and Analytic Geometry III1, 2
MAT 338 Ordinary Differential Equations2

Technical Electives2 ................................................................. 24 hrs

Unrestricted Electives ......................................................... 13-19 hrs

Total Curriculum Requirements ........................................... 120 hrs
1Fulfill University Studies requirements. Required for area if not taken as a University Studies requirement.
2This course is considered a program corequisite and may be shared with a minor or second major.
3The technical electives are to be a coherent set of courses chosen to supply depth and breadth necessary for the pursuit of a particular career objective. The chosen electives must be approved by a departmental curriculum committee.
Area: Applied Physics/Pre-MBA Track

Bachelor of Science/Bachelor of Arts Degree
CIP 40.0801

Students who wish to complete a scientific course of study and qualify for admission to Murray State’s Master of Business Administration program may follow the Applied Physics Curriculum/Pre-MBA track. Course requirements are identical to those listed under the Applied Physics program, with the exception of technical electives. Technical electives must be chosen in accordance with MBA admission guidelines, and are as follows:

Pre-MBA Required Electives ........................................................ 27 hrs
ACC 200 Principles of Financial Accounting
ACC 201 Principles of Managerial Accounting
BUS 355 Information Systems and Decision Making
CIS 443 Business Statistics III
ECO 230 Principles of Macroeconomics
ECO 231 Principles of Microeconomics
FIN 330 Principles of Finance
MGT 350 Fundamentals of Management
MKT 360 Principles of Marketing

Unrestricted Electives ................................................................. 6 hrs

Astronomy Minor .................................................................... 21 hrs
AST 115, 116, 316; PHY 130, 131, 132, 133, and six additional hours of approved astronomy courses numbered 300 and above. PHY 235 and 255 may be substituted for PHY 130 and 132 with approval from the department chair. Physics majors must take CHE 201 and GSC 101 in place of PHY 130, 131, 132, and 133. Six hours must be upper-level courses completed at Murray State University.

Physics Minor ...................................................................... 22 hrs
PHY 235, 236, 255, 256, 370, and nine additional hours of approved physics courses numbered 300 and above. PHY 130 and 132 may be substituted for PHY 235 and 255 with approval from the department chair. Six hours must be upper-level courses completed at Murray State University.

Engineering Technology Accreditation
The Technology Accreditation Commission of ABET (TAC/ABET) accredits Murray State programs in civil and construction engineering technology. The Civil Engineering Technology/General Track and the Civil Engineering Technology/Construction Track programs are accredited by the Technology Accreditation Commission of ABET, 111 Market Place, Suite 1050, Baltimore, MD 21202-4012. Phone (410) 347-7700.

Professional Licensure
Students interested in pursuing a career as a professional land surveyor must complete courses specified by the Kentucky Board of Licensure for Professional Engineering and Land Surveyors (www.boels.ky.gov). Required courses may be taken as electives by students in the Civil Engineering Technology program under the supervision of an advisor. Students completing Board requirements normally sit for the Fundamentals of Surveying exam in their last semester at Murray State University.

Engineering Technology
The Engineering Technology programs are: Architectural Engineering Technology, Civil Engineering Technology, Construction Engineering Technology, Electromechanical Engineering Technology, and Environmental Engineering Technology.

•Civil Engineering Technology
A baccalaureate degree in civil engineering technology provides students with a background in the design of steel and concrete structures, surveying, soil mechanics and foundations, construction materials, and engineering mechanics. Potential employers include construction companies, consulting engineering and architectural firms, state and federal governments, municipalities, testing laboratories, surveying firms, utilities, and materials suppliers.

The civil engineering technology program prepares graduates for careers in design (working with a team of engineers or architects in the preparation of engineering or architectural design documents), construction (as a field engineer, project engineer, or surveyor), or technical sales. An associate degree in civil engineering technology may also be obtained from Murray State University.

•Architectural Engineering Technology
A baccalaureate degree in architectural engineering technology provides students with a background in architectural design, computer-aided design, building structures and structural design, steel and concrete structures, surveying and site planning, and construction estimating. Potential employers include architectural firms, construction (design/build) companies, consulting engineering firms, state and federal governments, municipalities, materials suppliers, and utilities. Architectural engineering technologists are educated in the process of taking a project from the drawing to the completed structure. Working together with architects and engineers, they assist in producing drawings and specifications for major construction projects. Architectural engineering technology prepares graduates for careers in architectural design, planning, development, and construction as well as technical or sales positions in a variety of manufacturing organizations associated with
the building industry. An architectural engineering technology graduate seeking registration/licensure as an architect would usually pursue a Master of Architecture degree, typically requiring two or three years of additional study.

**Construction Engineering Technology**
A baccalaureate degree in construction engineering technology provides students with experience in construction, estimating, project management, scheduling, surveying, building structures, construction materials, and engineering mechanics. The curriculum stresses the application of technical knowledge, construction methods, problem-solving ability, and communication skills toward the completion of large-scale construction projects. Career opportunities for the construction-engineering technologist are as diverse as the industry. Potential employers include construction companies, general contractors, subcontractors, construction equipment and materials suppliers, testing laboratories, governments, industrial companies, and utilities.

The construction engineering technology program prepares graduates for supervisory and managerial careers within the construction industry. With a degree in construction engineering technology, the student will be qualified for an entry-level position as a construction project engineer, project manager, estimator, sales engineer, or field engineer.

**Environmental Engineering Technology**
A baccalaureate degree in environmental engineering technology provides graduates with backgrounds in municipals and industrial water and wastewater treatment system design and operations, water pollution control, solid and hazardous waste management and site remediation, air pollution control, and environmental regulatory compliance. Course work includes field and laboratory sampling and analysis plus design of pollution control systems.

Graduates obtain careers with industries, environmental consultants and remediation contractors, municipalities, testing laboratories, state or federal government agencies, and chemical manufacturing corporations.

**Electromechanical Engineering Technology**
A baccalaureate degree in electromechanical engineering technology provides students with backgrounds in mechanical and electrical systems, fluid power, controls, and industrial networks. Electromechanical graduates work in manufacturing and process plant engineering, operation, maintenance, new product design, systems design, system analysis, and systems integration.

The electromechanical engineering technologist is a blend of mechanical and electrical engineering technology, computer science, information technology, and control systems. Graduates have broad application backgrounds in automation, electronics, data acquisition, controls, programming, and mechanical and electrical science principles. This allows students to understand the design and operation of systems found in the plant environment.

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**ASSOCIATE:**
**Civil Engineering Technology**

Associate of Science Degree
CIP 15.0201

University Studies Requirements ........................................ 23 hrs
(See Academic Degrees and Programs.)

University Studies selections must include:

**Scientific Inquiry, Methodologies, and Quantitative Skills**

<table>
<thead>
<tr>
<th>Course</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHY 130</td>
<td>General Physics I</td>
</tr>
<tr>
<td>PHY 131</td>
<td>General Physics I Laboratory</td>
</tr>
</tbody>
</table>

**Required Courses** ................................................. 32 hrs

<table>
<thead>
<tr>
<th>Course</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>CET 280</td>
<td>Plane Surveying</td>
</tr>
<tr>
<td>CET 284</td>
<td>Sustainable Design and Construction</td>
</tr>
<tr>
<td>CET 385</td>
<td>Construction Estimating I</td>
</tr>
<tr>
<td>ENG 324</td>
<td>Technical Writing</td>
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<tr>
<td>ENT 100T</td>
<td>Transitions</td>
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<tr>
<td>ENT 287</td>
<td>Statics for Technology</td>
</tr>
<tr>
<td>ENT 358</td>
<td>Mechanical and Electrical Systems</td>
</tr>
<tr>
<td>ITD 107</td>
<td>Introduction to Technical Drawing and Computer-Aided Drafting</td>
</tr>
</tbody>
</table>

**Support Courses** .................................................... 13 hrs

<table>
<thead>
<tr>
<th>Course</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>GSC 101</td>
<td>The Earth and the Environment</td>
</tr>
<tr>
<td>MAT 130</td>
<td>Technical Math I</td>
</tr>
<tr>
<td>PHY 132</td>
<td>General Physics II</td>
</tr>
<tr>
<td>PHY 133</td>
<td>General Physics II Laboratory</td>
</tr>
</tbody>
</table>

**Total Curriculum Requirements** ........................................ 62 hrs
**AREA: Civil Engineering Technology**

Bachelor of Science Degree  
CIP 15.0201

ACCREDITED BY:  
Technology Accreditation Commission of ABET, 111 Market Place, Suite 1050, Baltimore, MD 21202-4012. (410) 347-7700

**University Studies Requirements**  ........................................ 44-46 hrs  
(See Academic Degrees and Programs.)

University Studies selections must include:

- **Scientific Inquiry, Methodologies, and Quantitative Skills**
  - MAT 130 Technical Math I
  - PHY 130 General Physics I and
  - PHY 131 General Physics I Laboratory
  - PHY 132 General Physics II and
  - PHY 133 General Physics II Laboratory
- **Social and Self-Awareness and Responsible Citizenship**
  - ECO 230 Principles of Macroeconomics
- **University Studies Electives**
  - GSC 101 The Earth and the Environment
  - MAT 230 Technical Math II

**Core Courses**  ................................................................. 41 hrs

- CET 280 Plane Surveying
- CET 284 Sustainable Design and Construction
- CET 385 Construction Estimating I
- CET 480 Construction Planning and Management
- ENG 324 Technical Writing
- ENT 100T Transitions
- ENT 287 Statics for Technology
- ENT 358 Mechanical and Electrical Systems
- ENT 382 Hydraulics
- ENT 393 Engineering Economy
- ENT 419 Senior Project I
- IET 399 Professional Development Seminar I
- IET 488 Cooperative Education/Internship
- ITD 107 Introduction to Technical Drawing and Computer-Aided Drafting
- MAT 330 Technical Math III

**Track Courses**  ................................................................. 35 hrs

- CET 298 Strength of Materials
- CET 370 Route Surveying
- CET 481 Structural Steel Design
- CET 482 Reinforced Concrete Design
- CET 483 Construction Materials
- CET 484 Soil Mechanics and Foundations
- CET 410 Transportation Systems and Design
- ENT 286 Introduction to Environmental Engineering Technology

Technical Electives (9 hrs)

**Total Curriculum Requirements** ........................................ 120 hrs
AREA: Civil Engineering Technology/Architectural Engineering Technology Track

Bachelor of Science Degree
CIP 15.0201

University Studies Requirements ........................................ 44-46 hrs
(See Academic Degrees and Programs.)

University Studies selections must include:
• **Scientific Inquiry, Methodologies, and Quantitative Skills**
  MAT 130  Technical Math I
  PHY 130  General Physics I
  PHY 131  General Physics I Laboratory
  PHY 132  General Physics II
  PHY 133  General Physics II Laboratory
• **Social and Self-Awareness and Responsible Citizenship**
  ECO 230  Principles of Macroeconomics
• **University Studies Electives**
  GSC 101  The Earth and the Environment
  MAT 230  Technical Math II

**Core Courses** ................................................................. 41 hrs
CET 280  Plane Surveying
CET 284  Sustainable Design and Construction
CET 385  Construction Estimating I
CET 480  Construction Planning and Management
ENG 324  Technical Writing
ENT 100T  Transitions
ENT 286  Introduction to Environmental Engineering Technology
ENT 287  Statics for Technology
ENT 358  Mechanical and Electrical Systems
ENT 382  Hydraulics
ENT 393  Engineering Economy
ENT 419  Senior Project I
IET 399  Professional Development Seminar I
IET 488  Cooperative Education/Internship
ITD 107  Introduction to Technical Drawing and Computer-Aided Drafting
MAT 330  Technical Math III

**Track Courses** ............................................................... 35 hrs
CET 298  Strength of Materials
CET 310  Anatomy of Buildings
CET 481  Structural Steel Design
CET 482  Reinforced Concrete Design
CET 483  Construction Materials
CET 490  Construction Scheduling and Methods
ITD 104  Computer Aided Design
ITD 301  Architectural Design I
ITD 401  Architectural Design II
ITD 503  Architectural Design III

**Total Curriculum Requirements** .................................... 120 hrs
AREA: Civil Engineering Technology/Construction Engineering Technology Track

Bachelor of Science Degree
CIP 15.0201

ACCREDITED BY:
Technology Accreditation Commission of ABET, 111 Market Place, Suite 1050, Baltimore, MD 21202-4012. (410) 347-7700

University Studies Requirements ................................. 44-46 hrs
(See Academic Degrees and Programs.)

University Studies selections must include:
• Scientific Inquiry, Methodologies, and Quantitative Skills
  MAT 130 Technical Math I
  PHY 130 General Physics I
  PHY 131 General Physics I Laboratory
  PHY 132 General Physics II
  PHY 133 General Physics II Laboratory
• Social and Self-Awareness and Responsible Citizenship
  ECO 230 Principles of Macroeconomics
• University Studies Electives
  GSC 101 The Earth and the Environment
  MAT 230 Technical Math II

Core Courses ............................................................... 41 hrs
CET 280 Plane Surveying
CET 284 Sustainable Design and Construction
CET 385 Construction Estimating I
CET 480 Construction Planning and Management
ENG 324 Technical Writing
ENT 100T Transitions
ENT 287 Statics for Technology
ENT 358 Mechanical and Electrical Systems
ENT 382 Hydraulics
ENT 393 Engineering Economy
ENT 419 Senior Project
IET 399 Professional Development Seminar I
IET 488 Cooperative Education/Internship
ITD 107 Introduction to Technical Drawing and Computer-Aided Drafting
MAT 330 Technical Math III

Track Courses ............................................................. 36 hrs
ACC 200 Principles of Financial Accounting
CET 298 Strength of Materials
CET 310 Anatomy of Buildings
CET 386 Construction Estimating II
CET 481 Structural Steel Design
CET 482 Reinforced Concrete Design
CET 483 Construction Materials
CET 484 Soil Mechanics and Foundations
CET 490 Construction Scheduling and Methods
MGT 350 Fundamentals of Management
OSH 384 Construction Safety

Total Curriculum Requirements ...................................... 121 hrs
AREA: Civil Engineering Technology/Environmental Engineering Technology Track

Bachelor of Science Degree
CIP 15.0201

University Studies Requirements .......................... 44-46 hrs
(See Academic Degrees and Programs.)

University Studies selections must include:

• **Scientific Inquiry, Methodologies, and Quantitative Skills**
  - MAT 130 Technical Math I
  - PHY 130 General Physics I
  - PHY 131 General Physics I Laboratory
  - PHY 132 General Physics II
  - PHY 133 General Physics II Laboratory

• **Social and Self-Awareness and Responsible Citizenship**
  - ECO 230 Principles of Macroeconomics

• **University Studies Electives**
  - GSC 101 The Earth and the Environment
  - MAT 230 Technical Math II

Core Courses .......................................................... 41 hrs
- CET 280 Plane Surveying
- CET 284 Sustainable Design and Construction
- CET 385 Construction Estimating I
- CET 480 Construction Planning and Management
- ENG 324 Technical Writing
- ENT 100T Transitions
- ENT 287 Statics for Technology
- ENT 358 Mechanical and Electrical Systems
- ENT 382 Hydraulics
- ENT 393 Engineering Economy
- ENT 419 Senior Project
- IET 399 Professional Development Seminar I
- IET 488 Cooperative Education/Internship
- ITD 107 Introduction to Technical Drawing and Computer-Aided Drafting
- MAT 330 Technical Math III

Track Courses .................................................. 35 hrs
- CET 330 Water Quality Technology I
- CET 331 Water Quality Technology II
- CET 342 Air Quality Technology
- CET 353 Solid and Hazardous Waste Management
- CET 555 Environmental Regulatory Affairs
- CET 585 Remediation Technology
- CHE 111 Essentials of Chemistry and Biochemistry
- ENT 286 Introduction to Environmental Engineering Technology
- ENT 400 Energy Management
- Technical Electives (6 hrs)

Total Curriculum Requirements ................................ 120 hrs
AREA: Electromechanical Engineering Technology

Bachelor of Science Degree
CIP 15.0403

University Studies Requirements ..................................................... 43-47 hrs
(See Academic Degrees and Programs.)

University Studies selections must include:
• **Scientific Inquiry, Methodologies, and Quantitative Skills**
  MAT 130  Technical Math I
  or
  MAT 150  Algebra and Trigonometry
  MAT 308  Calculus and Analytic Geometry II
  or
  MAT 330  Technical Math III
  PHY 130  General Physics I and
  PHY 131  General Physics I Laboratory
  or
  PHY 235  Mechanics, Heat and Wave Motion and
  PHY 236  Mechanics, Heat and Wave Motion Laboratory
• **Social and Self-Awareness and Responsible Citizenship**
  ECO 230  Principles of Macroeconomics
• **University Studies Electives**
  MAT 230  Technical Math II
  or
  MAT 250  Calculus and Analytic Geometry I
  PHY 132  General Physics II and
  PHY 133  General Physics II Laboratory
  or
  PHY 255  Electricity, Magnetism and Light and
  PHY 256  Electricity, Magnetism and Light Laboratory

**Core Courses** .............................................................................. 62 hrs
CET 298  Strength of Materials
EMT 201  Engineering Technology Simulation
EMT 202  Engineering Technology Analysis
EMT 261  Introduction to Fluid Power Systems
EMT 262  Introduction to Fluid Power Systems Laboratory
EMT 310  Programmable Logic Controllers
EMT 312  Industrial Instrumentation
EMT 355  Electrical Machinery and Controls
EMT 455  Manufacturing Control Systems
EMT 461  Motion Controls
ENT 287  Statics for Technology
ENT 351  Industrial and Commercial Power Distribution
ENT 358  Mechanical and Electrical Systems
ENT 365  Dynamics for Technology
ENT 393  Engineering Economy
TSM 110  Electrical Systems I
TSM 210  Electrical Systems II
TSM 232  Operating Systems
TSM 241  Networking Fundamentals

**Support Courses** ......................................................................... 15 hrs
ENG 324  Technical Writing
ENT 100T  Transitions
IET 399  Professional Develop Seminar I
IET 488  Cooperative Education/Internship
ITD 102  CAD Applications
Technical Electives (6 hrs)

**Total Curriculum Requirements** ............................................. 120-124 hrs
Industrial Technology and Design
The Industrial Technology tracks are: Engineering and Graphics Design, Interior Design, and Manufacturing Technology.

• Engineering Graphics and Design
A baccalaureate degree in engineering graphics and design provides students with the fundamentals of design principles, computer aided design, and commercial/industrial design standards. Graduates will be prepared to work with engineers and architects in designing, constructing and manufacturing in modern industrial and architectural corporations.

This broad based program emphasizes computer aided design, and design graphics including: mechanical engineering drawings, renderings, technical animations and 3D parametric design. Applied engineering and engineering design/CAD are typical job descriptors for engineering graphics and design graduates.

Engineering graphics and design graduates typically find jobs in manufacturing companies, engineering consulting firms, and architectural firms utilizing cutting edge computer graphic design capabilities and applied engineering concepts in the design of modern processes, components and structures.

• Interior Design
A baccalaureate degree in interior design provides students with the fundamentals of design, design analysis, space planning, the design of all interior spaces, and an understanding of related aspects of environmental design. In addition, graduates will be able to conduct research and solve problems relative to the function and quality of interior design. Graduates will be prepared to work as a professional interior designer, and with architects and engineers in designing interiors for residential and commercial buildings.

This program prepares graduates to enter positions in interior design and related areas in environmental design and to work in private business where interior design knowledge is critical. With a broad range of skills in technical drawing and CAD, architectural drawing, engineering graphics, and designing interiors graduates are prepared to work in a variety of architectural construction, and engineering consulting firms as interior designers.

• Manufacturing Technology
A baccalaureate degree in manufacturing technology provides students with a broad range of knowledge and skills related to industry and industrial supervision. Graduates from this program are exposed to the applied aspects of industrial processes, production systems, production management, computer integrated design, computer aided drafting, manufacturing systems, human relations and human resource development. The graduates from this program will generally work in one of a variety of industries working directly with engineers, designers, and production personnel as supervisors and technical support, utilizing skills in computer numerical control, hydraulics, machine tool processes, CAD, CAM, computer integration, industrial automation and system integration. Additional skills in electrical systems, accounting, marketing, human resource management and business management allows graduates to work in a variety of industrial environments.

AREA:
Engineering Graphics and Design

Bachelor of Science Degree
CIP 15.1302

University Studies Requirements ........................................ 45 hrs
(See Academic Degrees and Programs.)

University Studies selections must include:
• Scientific Inquiry, Methodologies, and Quantitative Skills
  CHE 105 Introductory Chemistry
  MAT 135 Introduction to Probability and Statistics
  PHY 130 General Physics I
  PHY 131 General Physics I Laboratory

• Social and Self-Awareness and Responsible Citizenship
  ECO 231 Principles of Microeconomics

• University Studies Electives
  CSC 199 Introduction to Information Technology
  MAT 230 Technical Math II

Core Courses ................................................................. 38 hrs
  ENG 324 Technical Writing
  IET 399 Professional Development Seminar I
  IET 488 Cooperative Education/Internship
  ITD 100T Transitions
  ITD 101 Introduction to Design and Graphic Communications
  ITD 104 Computer Aided Design
  ITD 130 Manufacturing Processes and Materials
  ITD 204 Parametric Modeling and Rendering
  ITD 301 Architectural Design I
  ITD 350 Construction Systems
Required Courses ......................................................... 26 hrs
CET 298 Strength of Materials
ENT 287 Statics for Technology
ITD 202 Applied Technical Drawing
ITD 304 Advanced Parametric Modeling
ITD 306 Engineering Graphics
ITD 330 Machine Tool Processes
ITD 333 ANSI Fundamentals for Mechanical Product Design

Emphasis ........................................................................ 11 hrs
Choose one area of emphasis below:
**Industrial/Manufacturing Design**
IET 587 Quality Control
ITD 403 Product and Tooling Design
ITD 498 Industrial Design Processes and Prototypes

**Architectural/Construction Design**
CET 310 Anatomy of Buildings
ITD 401 Architectural Design II
ITD 503 Architectural Design III

Total Curriculum Requirements .................................... 120 hrs

AREA:
**Interior Design**

Bachelor of Science Degree
CIP 15.1302

ACCREDITED BY:
The National Kitchen and Bath Association (NKBA)

University Studies Requirements .................................. 46 hrs
(See Academic Degrees and Programs.)

University Studies selections must include:
• **Scientific Inquiry, Methodologies, and Quantitative Skills**
  CHE 105 Introductory Chemistry
  MAT 135 Introduction to Probability and Statistics
  PHY 130 General Physics I
  PHY 131 General Physics I Laboratory

• **Social and Self-Awareness and Responsible Citizenship**
  ECO 231 Principles of Microeconomics
  or
  SOC 133 Introduction to Sociology

• **University Studies Electives**
  CSC 199 Introduction to Information Technology
  MAT 117 Mathematical Concepts (or higher)

Core Courses ............................................................... 38 hrs
ENG 324 Technical Writing
IET 399 Professional Development Seminar I
IET 488 Cooperative Education/Internship
ITD 100T Transitions
ITD 101 Introduction to Design and Graphic Communications
  or
  ITD 107 Introduction to Technical Drawing and Computer-Aided Drafting
ITD 104 Computer Aided Design
ITD 130 Manufacturing Processes and Materials
ITD 204 Parametric Modeling and Rendering
ITD 301 Architectural Design I
ITD 350  Construction Systems
MAT 130  Technical Math I
MGT 350  Fundamentals of Management

Required Courses ............................................................... 37 hrs
CET 284  Sustainable Design and Construction
ITD 221  Design Visualization
ITD 253  Interior Design Studio I
ITD 351  Materials and Textiles for Interiors
ITD 352  History of Interiors I
ITD 353  Interior Design Studio II
ITD 357  Interior Design Studio III
ITD 401  Architectural Design II
ITD 452  History of Interiors II
ITD 453  Interior Design Studio IV
ITD 455  Interior Design Studio V
ITD 459  Professional Practice
ITD 503  Architectural Design III

Total Curriculum Requirements ........................................ 121 hrs

AREA:
Manufacturing Technology

Bachelor of Science Degree
CIP 15.0613

University Studies Requirements ........................................ 45 hrs
(See Academic Degrees and Programs.)

University Studies selections must include:
+ Scientific Inquiry, Methodologies, and Quantitative Skills
CHE 105  Introductory Chemistry
MAT 135  Introduction to Probability and Statistics
PHY 130  General Physics I
PHY 131  General Physics I Laboratory
+ Social and Self-Awareness and Responsible Citizenship
ECO 231  Principles of Microeconomics
+ University Studies Electives
CSC 199  Introduction to Information Technology
MAT 230  Technical Math II

Core Courses ................................................................. 38 hrs
ENG 324  Technical Writing
IET 399  Professional Development Seminar I
IET 488  Cooperative Education/Internship
ITD 100T Transitions
ITD 101  Introduction to Design and Graphic Communications
ITD 104  Computer Aided Design
ITD 130  Manufacturing Processes and Materials
ITD 204  Parametric Modeling and Rendering
ITD 301  Architectural Design I
ITD 350  Construction Systems
MAT 130  Technical Math I
MGT 350  Fundamentals of Management

Required Courses ............................................................... 37 hrs
EMT 261  Introduction to Fluid Power Systems
EMT 262  Introduction to Fluid Power Systems Laboratory
EMT 310  Programmable Logic Controllers
IET 587  Quality Control
ITD 202  Applied Technical Drawing
ITD 306  Engineering Graphics
ITD 330  Machine Tool Processes
MGT 551  Organizational Behavior  
TSM 110  Electrical Systems  
Technical Electives (7 hrs)

**Total Curriculum Requirements** ......................................... 120 hrs

**ASSOCIATE:**  
**Industrial Technology**

**Associate of Science Degree**  
CIP 15.0612

**University Studies Requirements** ...................................... 22 hrs  
(See Academic Degrees and Programs.)

University Studies selections must also include:  

- **Scientific Inquiry, Methodologies, and Quantitative Skills**  
  MAT 130  Technical Math I  
  PHY 130  General Physics I  
  PHY 131  General Physics I Laboratory

- **Social and Self-Awareness and Responsible Citizenship**  
  ECO 231  Principles of Microeconomics

**Required Courses** ............................................................ 28 hrs  
EMT 261  Introduction to Fluid Power Systems  
EMT 262  Introduction to Fluid Power Systems Laboratory  
IET 399  Professional Development Seminar I  
ITD 100T  Transitions  
ITD 101  Introduction to Design and Graphic Communications  
ITD 104  Computer Aided Design  
ITD 130  Manufacturing Processes and Materials  
ITD 204  Parametric Modeling and Rendering  
ITD 330  Machine Tool Processes  
TSM 110  Electrical Systems I

**Technical Electives** .......................................................... 14 hrs

**Total Curriculum Requirements** ........................................ 64 hrs

**Environmental Technology Minor** ................................. 21 hrs
CET 284, 330, 331, 342, 353, 555, and ENT 286. Prerequisite courses are not applicable to this minor. Six hours must be upper-level courses completed at Murray State University.

**Industrial and Engineering Technology Minor** ................... 21 hrs
Program must be approved by an advisor with at least six hours of courses at 300-level or above completed at Murray State University.

**Graduate Program**

Graduate Coordinator - Michael Kemp

The Department of Industrial and Engineering Technology offers the Master of Science degree in Applied Engineering and Technology Management. This degree is designed for individuals who wish to further their knowledge of management, leadership, and technology. The program is appropriate for graduates with backgrounds in technology, engineering, science, and mathematics and other related fields who have significant business/industrial work experience.

The applied engineering and technology management degree places emphasis on the involvement with real situations and problems for an industrial setting. A broad range of selections are provided in the areas of resource management, supervision and training, quality control, environment and safety management, business and finance, research, communications, and information systems.

**Requirements for Admission**
Applicants must meet the Murray State University requirements (see Graduate Admissions). Additional requirements for unconditional and conditional admission are as follows. The Graduate Record Examination (GRE) is not required for admission to this program.
Unconditional

Admission to the Master of Science degree in Applied Engineering and Technology Management is open to persons holding a baccalaureate or higher degree from a regionally accredited college in engineering, engineering technology, science, or related fields. Persons holding degrees in other fields may also apply if the nature of the professional employment has provided significant technology-related experience. Courses included in the program of study may require prerequisite course work.

Unconditional admission requires a 2.75 grade point average (GPA based on an A equals 4.0).

Conditional

Students denied unconditional admission to Master of Science degree programs in the Department of Industrial and Engineering Technology, but who meet University requirements for conditional admission, may petition for conditional admission. Conditional admission is usually reserved for applicants whose previous education and/or experience is evaluated by the department chair to indicate a likelihood of success. Students applying for conditional admission must have a GPA of 2.25 to 2.74. A student accepted conditionally will be expected to complete nine hours of prescribed work with a minimum 3.0/4.0 GPA. These initial nine hours are assigned by the advisor and may be in addition to the student’s program of study. After completion of these nine hours the Departmental Graduate Committee will evaluate the student’s progress. The first nine hours may include undergraduate or graduate courses as directed by the department. Depending on the student’s undergraduate preparation, undergraduate courses may be required before enrolling in any graduate courses. Graduate courses may be allowed concurrently with these undergraduate courses in special situations.

Language Proficiency

Applicants whose native tongue is not English or who did not graduate from an English speaking college or university must demonstrate language proficiency. Applicants must adhere to the university’s guidelines for language proficiency.

Master of Science in Applied Engineering and Technology Management

CIP 15.0000

The Applied Engineering and Technology Management program is designed for individuals who are seeking positions of increased leadership and responsibility in business, industry, and government. Emphasis is placed on involvement with real situations and problems. The student, in consultation with an advisor, will develop an interdisciplinary plan of study to increase skills in a specific technical area and to strengthen abilities to communicate effectively in the management of technical functions.

Total Course Requirements ...................................................... 30 hours
CET 682 Industrial Environmental Management
IET 684 Engineering Economic Analysis
IET 691 Industrial Operations
IET 693 Systems Management Technology
IET 695 Industrial Supervision
IET 697 Research in Industrial and Engineering Technology

Electives ............................................................................. 12 hrs
Select four electives with advisor approval. (No more than two courses total may be taken with the following prefixes: ACC, BUS, CIS, FIN, MGT, or MKT.)

Other Degree Requirements

• A written comprehensive examination is required as a component of graduation requirements.
• Independent study, special problems, and workshop courses may only be taken in special circumstances and with prior advisor and instructor approval.

Telecommunications Systems Management

Telecommunications systems are networks of leading-edge technologies such as fiber optic systems, satellites, wireless, telephony, and cable, which are connected to computers that allow organizations and individuals throughout business and industry to communicate instantaneously around the world. Telecommunications systems provide the architectural structure for such activities as electronic commerce, electronic banking, video teleconferencing, distance learning, telemedicine, data interchange, on-demand video, wireless technology, information security, and a host of other traditional and new uses for business and industry.

The baccalaureate program provides students specialization tracks within the curriculum. Students in the baccalaureate program will have the insight and ability to function in all areas of Telecommunications Systems Management (TSM) but will choose a program emphasis that will support the aspect of management which interests them most - the physical system and its components, the software that drives the system, or the business structure and operations that depend on the system. In addition, they will be prepared to move on to the Master of Science in Telecommunications Systems Management if they so choose.

Telecommunications Systems Management is an interdisciplinary program drawing upon the strengths of the Bauernfeind College of Business and the Jones College of Science, Engineering and Technology. These programs which are jointly administered by the two colleges provide students a unique opportunity to develop both technical expertise and management expertise in this dynamic field.
Due to the dynamic nature of the field of telecommunications, new courses may be developed that may require substitution for existing courses in the program.

AREA:  
Telecommunications Systems Management

Bachelor of Science  
CIP 11.0401

University Studies Requirements ........................................ 44 hrs  
(See Academic Degrees and Programs.)

University Studies selections must include:

- **Scientific Inquiry, Methodologies, and Quantitative Skills**
  MAT  135  Introduction to Probability and Statistics  
  MAT  140  College Algebra  
  PHY  125  Brief Introductory Physics  
  PHY  126  Brief Introductory Physics Laboratory

- **Social and Self-Awareness and Responsible Citizenship**
  ECO  231  Principles of Microeconomics

- **University Studies Electives**
  CSC  101  Introduction to Problem Solving Using Computers  
  CSC  199  Introduction to Information Technology

Required Courses ............................................................. 59 hrs

ACC  200  Principles of Financial Accounting  
CIS  307  Decision Support Technologies  
CIS  317  Principles of Information Systems Analysis and Design  
CSC  235  Programming in C++  
ECO  335  Economics and Public Policy of the Telecommunications Industry  
FIN  330  Principles of Finance  
MGT  350  Fundamentals of Management  
MKT  360  Principles of Marketing  
TSM  100T  Transitions  
TSM  133  Telecommunications Technology and Methods  
TSM  232  Operating Systems  
TSM  233  Network Services  
TSM  241  Networking Fundamentals  
TSM  320  Introduction to Wireless Technology  
TSM  343  Protocol Analysis  
TSM  351  Principles of Information Security  
TSM  411  Network Design, Operations and Management  
TSM  443  Telephone Technology  
TSM  488  Cooperative Education/Internship

Selected Emphasis ............................................................. 21 hrs

Choose any of the methods of completion below:

1) Select specific classes;  
2) Select one or more complete emphasis areas;  
3) Select approved electives to total 24 hours.

Note: When selecting courses for an area of emphasis or as an elective, a maximum of nine hours may be selected from courses with a business prefix including: ACC, BUS, CIS, FIN, MGT, MKT, or OSY. Adherence to course prerequisites is critical.

**Wireless Communications Electronics**

TSM  321  Wireless Communications  
TSM  322  Wireless Communications II  
TSM  323  Wireless Mobile Internet  
TSM  421  Mobile Satellite Communications

**Network Security**

TSM  352  System Security  
TSM  353  Network Security  
TSM  440  Information Policy and Security Auditing  
TSM  441  Advanced Information Security
System Administration
CSC 310 Database Administration
CSC 360 Scripting Languages
TSM 450 Telecommunications Policy and Management
TSM 517 Systems Planning

Approved Electives
CSC 370 Introduction to Artificial Intelligence
ENG 324 Technical Writing
LSC 443 Fundamentals of Operations and Technology
MGT 358 Entrepreneurial Business Plan Development
MKT 475 Marketing Strategies in E-Commerce
TSM 444 Enterprise Networks

Total Curriculum Requirements ........................................ 124 hrs
*Maximum of three hours Internship or Cooperative Education counts toward a degree.

Telecommunications Systems Minor ................................. 21 hrs
TSM 133, 232, 233, and 241. Nine hours of advisor approved electives. Six hours must be 300- or 400-level courses completed at Murray State University.

Graduate Program
Graduate Coordinator - George Rice
270-809-6216

The master’s program in telecommunications systems management provides students a core of fundamental courses and the concentration of choosing a specialization within the curriculum. Although students in the master’s program will have the insight and ability to manage all aspects of telecommunications systems, the program concentration choice will support the aspect of management which interests them most, the physical systems and its components or the business structure and operations that depend on the system.

Requirements for Admission
Applicants must meet the Murray State University requirements (see Graduate Admissions).

Unconditional
For a TSM applicant to be unconditionally admitted to the program, an applicant must satisfy one of two formulas:
GMAT Users:  (200 x UGPA) + GMAT ≥ 1,000
GRE Users: GRE ≥ 321 - (11.66 x GPA - (Combined quantitative and verbal sections only.)

Note: The GRE formula uses the combined score from the quantitative and verbal sections only. Ask the Educational Testing Service (ETS) to send scores directly to Murray State University using our institution code: 1494.

In addition, candidates must take the TOEFL and score at least 550 on the paper-based exam (or 213 on the computerized version) if English is not their native language or they have not graduated from an accredited English speaking university.

Conditional
Applicants to the TSM graduate program may be admitted conditionally if their overall GPA is 2.75 or higher, or at least 3.0 for their last 60 hours of undergraduate study. Full admission to the program will be granted in one of only two ways, namely:

1) The applicant takes TSM 601, TSM 610 and one other core course (ACC 604, MGT 651, TSM 602, TSM 603, or TSM 630) as their first nine hours of the program and earns a GPA not less than 3.33 from the three core courses; or
2) the applicant takes the GMAT or GRE and meets the unconditional admission formula within their first semester in the program.

If neither of these two conditions is met, the student will be dropped from the program even if they have already taken graduate coursework.

International Admission
Applicants, from any country where English is a second language, will be required to demonstrate English language proficiency. This can be done by taking the Test of English as a Foreign Language (TOEFL) exam and score at least:
1) 550 pBT (paper-based test)
2) Minimum of 20 in each band iBT (internet-based test)
3) International English Language Testing System (IELTS) exam and score 6.0 on the academic test (with no band <5.5) to be fully admitted into the program.
Master of Science in Telecommunications Systems Management

CIP 11.0401

NON-THESIS REQUIREMENTS ONLY

Total Course Requirements ............................................. 30 hours
ACC 604 Quantitative Financial Controls
MGT 651 Seminar in Organizational Behavior
TSM 601 Telecommunications Principles
TSM 602 Telecommunications Systems
TSM 603 Telecommunications Project Management
TSM 610 Telecommunication Networks Management
TSM 630 Telecommunications Legal Environment: Law, Policy and Regulations
TSM 680 Telecommunications Solution Development
Electives (6 hrs)

Only one elective can be an ACC, BUS, CIS, FIN, MGT, or MKT prefix. Prefixes with no restrictions include: ECO, IET, and TSM. Other prefixes may be used with director’s approval. Check course descriptions for prerequisites. Not all 600-level courses are offered online.

CERTIFICATE:
Professional Telecommunications Systems Management

CIP 11.0103

The Certificate in Professional Telecommunications Systems Management is designed to complement traditional, disciplinary graduate and professional degree programs. The certificate program will provide professionals (e.g., medical administrators, corporate managers) with an overview of current terminology, practices and concepts related to the area of information technology and telecommunications systems. This certificate is an online delivery program.

Requirements for Admission

Students who hold an undergraduate degree, graduate degree, or are currently enrolled in a graduate or professional degree program may apply for the Certificate in Professional Telecommunications Systems Management program.

Applicants must comply with the Murray State University requirements (see Graduate Admissions). Additional requirements for admission are as follows:

Unconditional

For a TSM applicant to be unconditionally admitted to the program, an applicant must satisfy one of two formulas:
GMAT Users: \(200 \times \text{UGPA} + \text{GMAT} > 1,000\)
GRE Users: \(\text{GRE} > 321 - (11.66 \times \text{GPA})\) - (Combined quantitative and verbal sections only.)

Note: The GRE formula uses the combined score from the quantitative and verbal sections only. Ask the Educational Testing Service (ETS) to send scores directly to Murray State University using the institution code: 1494.

Conditional

An undergraduate GPA of 2.75 or higher, or at least 3.0 for their last 60 hours of undergraduate study.

Full admission to the program will be granted in one of only two ways, namely: 1) The applicant takes TSM 601, 610 and one other certificate course (TSM 602, 603, or 615) as their first nine hours of the program and earns a GPA not less than 3.33 from the three core courses; or 2) the applicant takes the GMAT or GRE and meets the unconditional admission formula within their first semester in the program.

International Admission

Applicants from any country where English is a second language will be required to demonstrate English language proficiency. This can be done by taking the Test of English as a Foreign Language (TOEFL) exam and score at least: 1) 550 pBT (paper-based test), 2) minimum of 20 in each band iBT (internet-based test), or 3) take the International English Language Testing System (IELTS) exam and score 6.0 on the academic test (with no band <5.5) to be fully admitted into the certificate program.

Total Course Requirements ............................................. 18 hours
TSM 601 Telecommunications Principles
TSM 602 Telecommunications Systems
TSM 603 Telecommunications Project Management
TSM 610 Telecommunications Networks Management
TSM 615 Information System Security
Elective (3 hrs)

Students may transfer up to six credit hours of equivalent graduate courses into the program.

The mission of the Department of Mathematics and Statistics is to engage the larger mathematical community through scholarship and research, to provide our service region with mathematical and statistical support for its educational and industrial objectives, and to equip our students with mathematical skills which they may apply in further degree programs and careers requiring expertise in mathematics. In particular, through our instruction and guidance we endeavor to provide our students with an understanding of mathematical ideas, and the ability to reason mathematically, analyze real world problems with mathematical techniques, and continue to read, learn, and communicate mathematics.

The department offers a major in mathematics, an area in mathematics with secondary certification, a major in mathematics with secondary certification, an area in applied mathematics, and an area in mathematics with a pre-MBA track. In these programs the student will learn mathematics as a fundamental discipline and as an essential tool in most other disciplines. Mathematics is also quite useful as a minor or second major. Additionally, the common awareness that mathematics is a substantial subject will enhance the prospects of any student who demonstrates a facility with the material.

Graduates with a major have gone on to careers in teaching, science, and industry. Some have improved their entry level prospects via graduate study at Murray State and/or in nationally known Ph.D. programs.

The area in applied mathematics will prepare the student for a career in business, industry, government or academics. The area consists of a core of applied mathematics courses and a 18-hour track in a related field. Each track contains further mathematical training, computer programming experience, and a broad study of a discipline which illustrates applications of mathematics. The program is intentionally flexible and, by its interdisciplinary nature, will provide the student with an understanding and experience in modeling and solving relative problems.

MAJOR:
Mathematics

Bachelor of Science/Bachelor of Arts Degree
CIP 27.0101

University Studies Requirements ......................... 38-44 hrs
(See Academic Degrees and Programs.)

Required Courses ....................................................... 25 hrs
MAT 100T Transitions
MAT 250 Calculus and Analytic Geometry I\(^1\)
MAT 308 Calculus and Analytic Geometry II\(^1\)
MAT 309 Calculus and Analytic Geometry III\(^1\)
MAT 312 Mathematical Reasoning\(^2\)
MAT 335 Matrix Theory and Linear Algebra
MAT 540 Mathematical Statistics I\(^1\)

Required Limited Electives.................................................. 15 hrs
Five MAT courses (3 or 4 credit hour) selected from MAT 338 and MAT courses numbered 400 or above including:
at least one of the following:
MAT 513 Modern Algebra I
MAT 516 Introduction to Topology
MAT 525 Advanced Calculus I
and least one of the following:
MAT 442 Introduction to Numerical Analysis
MAT 506 Mathematical Modeling I
MAT 524 Boundary Value Problems
MAT 541 Mathematical Statistics II

Co-Requirements.............................................................. 3-4 hrs
One course in computer programming selected from: CSC 145, 232, 235, or EGR 140.

Required Minor ............................................................ 21 hrs

Electives ................................................................. 11-18 hrs
Total Curriculum Requirements ........................................... 120 hrs
1 May be taken as a University Studies elective.
2 This is a University Studies writing intensive course.
3 This is a University Studies technology intensive course.

AREA:
Mathematics/Secondary Certification (Grades 8-12) Track

Bachelor of Science/Bachelor of Arts Degree
CIP 27.0101

University Studies Requirements ........................................ 42-43 hrs
(See Academic Degrees and Programs.)

University Studies selections must include:
• Scientific Inquiry, Methodologies, and Quantitative Skills
  MAT 250 Calculus and Analytic Geometry I
  MAT 308 Calculus and Analytic Geometry II
• Social and Self-Awareness and Responsible Citizenship
  PSY 180 General Psychology
• University Studies Electives
  EDP 260 Psychology of Human Development
  EDU 103 Issues and Practices of American Education
  1 Note: Certification requires a grade of B or better in one English composition course and a B or better in a University Studies math course, public speaking, and EDU 103 or equivalent course. Additional requirements for admission to teacher education and student teaching must be met. See advisor and/or Office of Teacher Education Services for details.

Required Courses ............................................................... 24 hrs
MAT 100T Transitions
MAT 309 Calculus and Analytic Geometry III
MAT 312 Mathematical Reasoning
MAT 335 Matrix Theory and Linear Algebra
MAT 517 Foundations of Geometry
MAT 540 Mathematical Statistics I
MAT 550 Teaching Mathematics
MAT 551 Mathematics for Teachers

Required Limited Electives ............................................. 18-20 hrs
Three MAT courses (3 or 4 credit hour) selected from MAT 338 and MAT courses numbered 400 or above including:
  at least one of the following:
  MAT 513 Modern Algebra I
  MAT 516 Introduction to Topology
  MAT 525 Advanced Calculus I
  and at least one of the following:
  MAT 442 Introduction to Numerical Analysis
  MAT 506 Mathematical Modeling I
  MAT 524 Boundary Value Problems
  MAT 541 Mathematical Statistics II
An additional course (at least 3 credit hours) selected from MAT 338 and MAT courses numbered 400 or above.
  and
At least three (3 or 4 credit hour) courses selected from courses numbered 400 or above or from courses related to the application of mathematics selected from a list approved by the Department of Mathematics and Statistics.

Co-Requirement ................................................................. 3 hrs
One course in computer programming selected from: CSC 145, 232, 235, or EGR 140.

Required for Secondary Certification .................................... 35 hrs
EDU 303 Strategies of Teaching
EDU 403 Structures and Foundations of Education
EDU 405 Evaluation and Measurement in Education
HEA 191 Personal Health
SEC 420 Practicum in Secondary Schools
SEC 421 Student Teaching in the Secondary School
SEC 422 Extended Practicum
SED 300 Educating Students with Disabilities
Total Curriculum Requirements .................................... 122-125 hrs
1With a grade of B or better.
2This is a University Studies writing intensive course.
3This is a University Studies technology intensive course.
4EDU 405 and SEC 420 must be taken together and two semesters before student teaching.
5Department of Mathematics and Statistics requirement.
6Must be taken one semester before student teaching.

MAJOR:
Mathematics/Secondary Certification (Grades 8-12) Track

Bachelor of Science/Bachelor of Arts Degree
CIP 27.0101

University Studies Requirements .................................. 42-45 hrs
(See Academic Degrees and Programs.)

University Studies selections must include:

• Scientific Inquiry, Methodologies, and Quantitative Skills
  MAT 250 Calculus and Analytic Geometry I
  MAT 308 Calculus and Analytic Geometry II

• Social and Self-Awareness and Responsible Citizenship
  PSY 180 General Psychology

• University Studies Electives
  EDP 260 Psychology of Human Development
  EDU 103 Issues and Practices of American Education

Note: Certification requires a grade of B or better in one English composition course and a B or better in a University Studies math course, public speaking, and EDU 103 or equivalent course. Additional requirements for admission to teacher education and student teaching must be met. See advisor and/or Office of Teacher Education Services for details.

Required Courses ..................................................... 21 hrs
MAT 100T Transitions
MAT 309 Calculus and Analytic Geometry III
MAT 312 Mathematical Reasoning
MAT 335 Matrix Theory and Linear Algebra
MAT 517 Foundations of Geometry
MAT 540 Mathematical Statistics I
MAT 550 Teaching Mathematics

Required Limited Electives ......................................... 9 hrs
Three MAT courses (3 or 4 credit hour) selected from MAT 338 and MAT courses numbered 400 or above including:

at least one of the following:
MAT 513 Modern Algebra I
MAT 516 Introduction to Topology
MAT 525 Advanced Calculus I

and at least one of the following:
MAT 442 Introduction to Numerical Analysis
MAT 506 Mathematical Modeling I
MAT 524 Boundary Value Problems
MAT 541 Mathematical Statistics II

An additional course (at least 3 credit hours) selected from MAT 338 and MAT courses numbered 400 or above.

Co-Requirement ......................................................... 3-4 hrs
One course in computer programming selected from: CSC 145, 232, 235, or EGR 140.

Required Minor ......................................................... 21 hrs

Required for Secondary Certification ................................ 35 hrs
EDU 303 Strategies of Teaching
EDU 403 Structures and Foundations of Education
EDU 405 Evaluation and Measurement in Education
HEA 191 Personal Health
SEC 420 Practicum in Secondary Schools
SEC 421 Student Teaching in the Secondary School
SEC 422 Extended Practicum
Total Curriculum Requirements .................................. 131-135 hrs
1With a grade of B or better.
2This is a University Studies writing intensive course.
3This is a University Studies technology intensive course.
4EDU 405 and SEC 420 must be taken together and two semesters before student teaching.
4Department of Mathematics and Statistics requirement.
4Must be taken one semester before student teaching.

AREA:
Mathematics/Applied Mathematics Track

Bachelor of Science/Bachelor of Arts Degree
CIP 27.0101

University Studies Requirements .................................. 38-44 hrs
(See Academic Degrees and Programs.)

Required Courses ...................................................... 31 hrs
MAT 100T Transitions
MAT 250 Calculus and Analytic Geometry II
MAT 308 Calculus and Analytic Geometry II
MAT 309 Calculus and Analytic Geometry III
MAT 312 Mathematical Reasoning
MAT 335 Matrix Theory and Linear Algebra
MAT 338 Ordinary Differential Equations
MAT 442 Introduction to Numerical Analysis
MAT 540 Mathematical Statistics I

Required Limited Electives ......................................... 27-28 hrs
A. Three (3 or 4 credit hour) courses selected from MAT courses numbered 400 or above.
B. Five or six courses (at least 3 credit hours) related to the application of mathematics. Must total at least 18 hours and must be approved by the student’s advisory committee.

Co-Requirements ...................................................... 6-8 hrs
Two courses in computer programming selected from a list approved by the Department of Mathematics and Statistics.

Unrestricted Electives ............................................. 9-18 hrs

Total Curriculum Requirements .................................. 120 hrs
1May be taken as a University Studies elective.
2This is a University Studies writing intensive course.
3This is a University Studies technology intensive course.
4The program is very flexible. For example, possible tracks include, but are not limited to, an emphasis in either biology, chemistry, computer science, engineering physics, geoscience, statistics and finance, or actuarial science.

AREA:
Mathematics/Pre-MBA Track

Bachelor of Science/Bachelor of Arts Degree
CIP 27.0101

University Studies Requirements .................................. 43-53 hrs
(See Academic Degrees and Programs.)

University Studies selections must include:
•Scientific Inquiry, Methodologies, and Quantitative Skills
  MAT 250 Calculus and Analytic Geometry I
  MAT 308 Calculus and Analytic Geometry II
•Social and Self-Awareness and Responsible Citizenship
  ECO 230 Principles of Macroeconomics
•University Studies Electives
  ECO 231 Principles of Microeconomics
  MAT 309 Calculus and Analytic Geometry III
Required Courses ............................................................... 39 hrs
ACC 200 Principles of Financial Accounting
ACC 201 Principles of Managerial Accounting
BUS 355 Information Systems and Decision Making
CSC 199 Introduction to Information Technology
FIN 330 Principles of Finance
MAT 100T Transitions
MAT 312 Mathematical Reasoning
MAT 335 Matrix Theory and Linear Algebra
MAT 540 Mathematical Statistics I
MAT 565 Applied Statistics I
MGT 350 Fundamentals of Management
MGT 443 Management of Operations and Technology
MKT 360 Principles of Marketing

Required Limited Electives ............................................. 12-13 hrs
Four (3 or 4 credit hour) courses selected from MAT 338 and MAT courses numbered 400 or above.

Co-Requirements ........................................................... 3-4 hrs
One course in computer programming selected from: CSC 145, 232, 235, or EGR 140.

Unrestricted Electives .................................................... 11-23 hrs

Total Curriculum Requirements ...................................... 120 hrs

Mathematics Minor ....................................................... 23 hrs
MAT 250, 308, 309 and nine hours of selected mathematics courses numbered above 309 (except for 330, 399, 554). Departmental approval required. Six hours must be upper-level courses completed at Murray State University.

Graduate Program

Graduate Coordinator - Timothy Schroeder

The Master of Science and Master of Arts degrees are designed to provide students with the opportunity to study graduate level mathematics so that they may (1) obtain preferred employment in mathematics with government or industry, (2) teach at the junior college level or be better prepared to teach at the secondary school level, or (3) continue working toward a doctor of philosophy degree.

The Master of Arts program is a broadly based program which includes a study of algebra, analysis, topology, and the foundations of mathematics. The Master of Science program consists of a core of applied mathematics together with a core (at most nine hours) in an allied field such as business, computer science, or physics. The program is flexible and is particularly suited to meet the needs of students preparing for careers in business, industry, or government.

The department also offers the Master of Arts in teaching degree in mathematics. This program is designed for certified teachers who wish to strengthen their discipline-based background and keep up with current information in educational theory, curriculum, and research.

All graduate programs in mathematics are planned in close consultation with the department graduate committee and are subject to its approval.

Requirements for Admission

Applicants must meet the Murray State University requirements (see Graduate Admissions). Additional requirements for unconditional and conditional admission to M.S. or M.A. programs are as follows:

Unconditional
- Bachelor’s degree from a regionally accredited college with a major (or equivalent) in mathematics or a related field;
- Overall GPA of 3.0 or above;
- Minimal GPA of 3.0 in all mathematics courses beginning with the first calculus course;
- Minimal GPA of 3.0 in all major courses; and
- If the major is in a related field (not mathematics), the student must have credit for three calculus courses (including a multivariable calculus course), a proof-based course, a matrix/linear algebra course, and a differential equations course.

Conditional
Recommendation of the department graduate committee or
- a bachelor’s degree from a regionally accredited college with a major in a related field and at least a 3.0 GPA in their major courses;
- Credit for three calculus courses (including a multivariable calculus course), a proof-based course, and a matrix/linear algebra course with a 3.0 GPA in all mathematics courses beginning with the last elementary calculus course;
• GPA of 3.0 or above in all mathematics courses beginning with the last elementary calculus course; and
• two letters of recommendation from college teachers addressing the candidate's ability to do mathematics graduate work.

Master of Arts in Mathematics

CIP 27.0101

THESIS REQUIREMENTS

Total Course Requirements ........................................ 30 hours
MAT courses, 700-level (3 hrs)
MAT courses, 600- or 700-level (21 hrs)
MAT 798-799 Research and Thesis (6 hrs)

Other Degree Requirements
• An advanced course in real analysis (MAT 725a–c).
• Oral defense and examination of thesis.

NON-THESIS REQUIREMENTS

Total Degree Requirements ........................................ 30 hours
MAT courses, 700-level (9 hrs)
MAT courses, 600- or 700-level (21 hrs)

Other Degree Requirements
• An advanced course in real analysis (MAT 725a–c).
• Comprehensive examinations over coursework.

1All coursework must be approved by the department graduate committee. The student must complete two, two-course sequences. If the student has not completed two semesters of advanced calculus then one of the sequences must be MAT 625-626. At most, one of these sequences may be a completion of a sequence that was started as an undergraduate.

Master of Science in Mathematics

CIP 27.0101

THESIS REQUIREMENTS

Total Course Requirements ........................................ 33 hours
MAT courses, 700-level (3 hrs)
MAT courses, 600 or 700-level (15–24 hrs)
Allied field, 600 or 700-level (0–9 hrs)
MAT 798-799 Research and Thesis (6 hrs)

Other Degree Requirements
• An advanced course in real analysis (MAT 725a–c).
• Oral defense and examination of thesis.

NON-THESIS REQUIREMENTS

Total Course Requirements ........................................ 33 hours
MAT courses, 700-level (9 hrs)
MAT courses, 600 or 700-level (15–24 hrs)
Allied field, 600 or 700-level (0–9 hrs)

Other Degree Requirements
• An advanced course in real analysis (MAT 725a–c).
• Comprehensive examinations over coursework.

1All coursework must be approved by the departmental graduate committee. The student must complete two, two-course sequences. If the student has not completed two semesters of advanced calculus then one of the sequences must be MAT 625-626. At most, one of these sequences may be a completion of a sequence that was started as an undergraduate.
Master of Arts in Teaching in Mathematics/Mathematics Teacher Leader (M.A.T.)

CIP 27.0101

The M.A.T. program is designed for certified teachers who wish to strengthen their background in mathematics and keep up with current information in educational theory, curriculum and research. The program provides for both reasonable depth in the mathematics area and graduate-level exposure in supporting disciplines. Completion of this program fulfills the requirements for Rank II classification. A student portfolio is required.

Requirements for Admission

Applicants must meet the Murray State University requirements (see Graduate Admissions). Additional requirements for unconditional and conditional admission to the M.A.T. program are as follows.

Unconditional

- Completion of requirements for teaching certification.
- Documentation of secondary teacher certification in the United States or comparable teacher qualification document from another country.
- Documentation of current certification for the duration of the program.
- Minor in mathematics with 3.0 minimum mathematics GPA.

Conditional

- See MSU requirements (see Graduate Admissions) and conditional admission requirements for certification (see College of Education and Human Services).
- Completion of requirements for teaching certification.
- Documentation of primary, middle, or secondary teacher certification in the United States or comparable teacher qualification document from another country.
- Documentation of current certification for the duration of the program.
- At least two calculus courses and two approved upper-level mathematics courses; and
- Two letters of recommendation from college teachers addressing the ability of the student to complete an M.A.T. degree in mathematics.

NON-THESIS REQUIREMENTS ONLY

Total Course Requirements ............................................ 33 hours
MAT courses, 700-level (3 hrs)
MAT courses, 600-level (15 hrs)

Education Courses
EDU 600 Introduction to Teacher Leadership
EDU 631 Classroom and Management and Student Motivation
EDU 633 Curriculum Development
EDU 637 Instruction for Diverse Learners
EDU 639 Research to Improve Student Learning
EDU 640 Exit Seminar in Teacher Leadership

Other Degree Requirements
Students must complete EDU 600 before enrolling in EDU 639.

Master of Arts in Education Secondary Teacher Leader with Mathematics Concentration

CIP 13.1205

The Department of Mathematics and Statistics provides instruction in support of the M.A.Ed. in Secondary Teacher Leader with a concentration in mathematics. Prospective students should contact the graduate coordinator in the College of Education and Human Services for details on advising and graduate program design.
Department of Occupational Safety and Health
157 Collins Center
270-809-2488


The Department of Occupational Safety and Health provides related curriculum offerings at the baccalaureate and master’s levels. Service courses are offered for individuals majoring in other fields such as business, science, health, psychology, education, and engineering technology. The department also offers a technical minor and a Master of Science degree, including an online Master of Science program with an emphasis in safety management that is equivalent to the on-campus program. The degree programs are designed to provide the technical and professional knowledge required by individuals pursuing professional careers in accident prevention, loss-control management and supervision, inspection and control of occupational hazards, industrial hygiene or environmental health and safety.

Occupational Safety and Health Track
This track is designed to provide the technical and professional knowledge required by individuals pursuing professional careers in accident prevention, loss control management and supervision, inspection and control of occupational hazards, and industrial hygiene.

Environmental Health and Safety Track
This track is designed to provide the technical and professional knowledge required by individuals pursuing professional careers in environmental issues and affairs such as water quality, air quality, and solid and hazardous waste management.

Requirements for Admission
Students may declare OSH as their area of choice at any point. However students must be formally admitted into the OSH program before they can enroll in restricted classes which are OSH 299, 353, 371, 387, or 400- and 500-level OSH classes. In order to be admitted to the OSH program, a student must (1) have completed at least 30 credit hours of coursework directly applicable to an OSH degree from the OSH University Studies requirements, required core courses, non-restricted OSH classes at the 100-, 200- and 300-levels, and technical electives, with a minimum GPA of 2.50; (2) have no grade less than a C in an OSH class; (3) complete an application packet for admission to the program; (4) be successfully reviewed by the OSH program admissions committee; (5) apply by February 1 for summer/fall enrollment or by September 1 for spring enrollment; (6) follow the most current bulletin when admitted to the program. Admission is competitive and based on available space. Admission is subject to application and careful evaluation by the OSH program admissions committee.

Degree Requirements
All occupational safety and health majors and minors must earn a grade of C or better in all OSH courses. Any OSH course with a grade below a C must be repeated. The maximum number of times a student may enroll in an OSH class is twice; this includes audits and withdrawals after the first week of class. Exceptions would be made only if the student was forced to drop the class due to a life-changing event and not due to performance in the class. If a grade less than C is received in any OSH course for a second time, the course cannot be repeated and the student is dismissed from the program and is not eligible for readmission. A cumulative grade point average of at least 2.50 must be maintained to graduate.

AREA:
Occupational Safety and Health/Occupational Safety and Health Track

Bachelor of Science
CIP 15.0701

ACCREDITED BY:

University Studies Requirements ............................................. 42 hrs
(See Academic Degrees and Programs.)

University Studies selections must include:
• Scientific Inquiry, Methodologies, and Quantitative Skills
  BIO 101 Biological Concepts
  CHE 105 Introductory Chemistry
  MAT 230 Technical Math II
• Social and Self-Awareness and Responsible Citizenship
  PSY 180 General Psychology
• University Studies Electives
  CSC 199 Introduction to Information Technology¹
  MAT 135 Introduction to Probability and Statistics
Required Core Courses ........................................................................................................ 51 hrs
ITD 120 Manufacturing Processes and Materials
MGT 350 Fundamentals of Management
OSH 100T Transitions
OSH 192 Introduction to Occupational Safety and Health
OSH 299 Professional Development Seminar I
OSH 310 Fire and Emergency Preparedness Preplanning
OSH 311 Hazardous Materials and Emergency Planning
OSH 320 Environmental and Occupational Health Engineering Technology
OSH 353 Prevention of Musculoskeletal Disorders in the Workplace
OSH 387 OSHA Standards for General Industry and Construction
OSH 420 Fundamentals of Industrial Hygiene
OSH 425 Physical Agents
OSH 450 Practical Application Lab
OSH 452 Systems Approach to Hazard Control
OSH 488 Cooperative Education/Internship
OSH 550 Safety and Health Program Management and Training
OSH 591 Engineering and Technical Aspects of Safety
PHY 125 Brief Introductory Physics
PHY 126 Brief Introductory Physics Lab

Safety Courses ............................................................................................................ 30 hrs
OSH 101 Emergency Medical Training
OSH 384 Construction Safety
OSH 445 Fundamentals of Loss Control
OSH 546 Fundamentals of Risk Control
Technical electives (15 hrs)
(Must be approved by advisor and chosen from the Technical Electives list below and/or the Environmental Health and Safety Track.)

Technical Electives (choose from the following)
CET 310 Anatomy of Buildings
CET 331 Water Quality Technology II
CET 385 Construction Estimating I
CET 480 Construction Planning and Management
CET 555 Environmental Regulatory Affairs
CHE 120 Chemical Laboratory Safety
CHE 210 Brief Organic Chemistry
CHE 215 Organic Chemistry Laboratory
CHE 330 Basic Biochemistry
COM 340 Intercultural Communication
COM 384 Communication Skills for Professionals
COM 439 Conflict and Communication
CRJ 140 Introduction to Criminal Justice
CRJ 355 Security in Business and Industry
ENG 228 Standard English Usage
MGT 550 Human Resource Management
MGT 555 Training and Development
MGT 575 Labor Management Relations
OSH 330 Global Issues in OSH
OSH 371 Professional Internship II
OSH 453 Human Factors in Safety Engineering
OSH 488 Cooperative Education/Internship
OSH 499 Professional Development Seminar II
OSH 536 Motor Fleet Safety
OSH 571 Problems in Safety and Health
OSH 578 Workshop in Safety and Health
PSY 405 Industrial and Organizational Psychology
SPA 106 Basic Spanish and Culture for Agriculture

Total Curriculum Requirements .......................................................... 123 hrs

1CSC 199 can be substituted by another computer related course with advisor’s approval.
2May be repeated for additional credit.
3May be repeated for a second experience.
### University Studies Requirements

(See Academic Degrees and Programs.)

University Studies selections must include:

- **Scientific Inquiry, Methodologies, and Quantitative Skills**
  - BIO 101 Biological Concepts
  - CHE 105 Introductory Chemistry
  - MAT 230 Technical Math II

- **Social and Self-Awareness and Responsible Citizenship**
  - PSY 180 General Psychology

- **University Studies Electives**
  - CSC 199 Introduction to Information Technology
  - MAT 135 Introduction to Probability and Statistics

### Required Core Courses

Required Core Courses .......................................................... 51 hrs

- ITD 120 Manufacturing Processes and Materials
- MGT 350 Fundamentals of Management
- OSH 100T Transitions
- OSH 192 Introduction to Occupational Safety and Health
- OSH 299 Professional Development Seminar I
- OSH 310 Fire and Emergency Preparedness Preplanning
- OSH 311 Hazardous Materials and Emergency Planning
- OSH 320 Environmental and Occupational Health Engineering Technology
- OSH 353 Prevention of Musculoskeletal Disorders in the Workplace
- OSH 387 OSHA Standards for General Industry and Construction
- OSH 420 Fundamentals of Industrial Hygiene
- OSH 425 Physical Agents
- OSH 450 Practical Application Lab
- OSH 452 Systems Approach to Hazard Control
- OSH 488 Cooperative Education/Internship
- OSH 550 Safety and Health Program Management and Training
- OSH 591 Engineering and Technical Aspects of Safety
- PHY 125 Brief Introductory Physics
- PHY 126 Brief Introductory Physics Lab

### Environmental Health and Safety Courses

Environmental Health and Safety Courses .............................. 30 hrs

- CET 330 Water Quality Technology I
- CET 342 Air Quality Technology
- CET 353 Solid Hazardous Waste Technology
- OSH 511 Hazardous Waste Site Operations
- OSH 523 Occupational Diseases
- OSH 527 Air Contaminants and Industrial Ventilation

Technical electives (12 hrs)

(Must be approved by advisor and chosen from the Technical Electives list below and/or the Occupational Safety and Health Track.)

### Technical Electives (choose from the following)

- CET 310 Anatomy of Buildings
- CET 331 Water Quality Technology II
- CET 385 Construction Estimating I
- CET 480 Construction Planning and Management
- CET 555 Environmental Regulatory Affairs
- CHE 120 Chemical Laboratory Safety
- CHE 210 Brief Organic Chemistry
- CHE 215 Organic Chemistry Laboratory
- CHE 330 Basic Biochemistry
COM 439 Conflict and Communication
COM 384 Communication Skills for Professionals
COM 340 Intercultural Communication
CRJ 140 Introduction to Criminal Justice
CRJ 355 Security in Business and Industry
ENG 228 Standard English Usage
MGT 550 Human Resource Management
MGT 555 Training and Development
MGT 575 Labor Management Relations
OSH 330 Global Issues in OSH\textsuperscript{2}
OSH 371 Professional Internship II
OSH 453 Human Factors in Safety Engineering
OSH 488 Cooperative Education/Internship\textsuperscript{3}
OSH 499 Professional Development Seminar II
OSH 536 Motor Fleet Safety
OSH 571 Problems in Safety and Health
OSH 578 Workshop in Safety and Health
PSY 405 Industrial and Organizational Psychology
SPA 106 Basic Spanish and Culture for Agriculture

Total Curriculum Requirements ........................................ 123 hrs
\textsuperscript{1} CSC 199 can be substituted by another computer related course with advisor’s approval.
\textsuperscript{2} May be repeated for additional credit.
\textsuperscript{3} May be repeated for a second experience.

OSH 192, 353, 387, 420, and nine hours from OSH 101, 320, 384, 425, 452. Six hours must be upper-level courses completed at Murray State University. Courses may require prerequisites.

**Graduate Program**

The graduate program in occupational safety and health is unique in this region. In light of an increased sensitivity to the safety of the work environment and to the overall health of all Americans, the program is a timely response to business and industry needs. Few programs of this type are found in higher education.

**Requirements for Admission**

Applicants must meet the Murray State University requirements (see Graduate Admissions). Additional requirements for unconditional and conditional admission are as follows.

**Unconditional**

Unconditional Admission status is granted only to students who graduate from Murray State University with a baccalaureate degree in occupational safety and health with an overall GPA of 3.00 or higher.

**Conditional**

Conditional Admission status is granted to students with an undergraduate GPA of 2.75 or higher, regardless of undergraduate baccalaureate degree field or major. To change to Unconditional status, the student must meet the university requirement of obtaining a 3.00 in the first nine hours of graduate work and additional criteria set forth by the Department of Occupational Safety and Health.

Students admitted from a different undergraduate field/discipline must complete the following course work in addition to the above GPA requirements. Undergraduate coursework is required in biology, chemistry, mathematics, and physics. The following courses are the minimum accepted requirements for pursuing a master’s degree in occupational safety and health.

- BIO 101
- CHE 105
- MAT 130 or MAT 140 and 145 or 150
- MAT 135 or PSY 300
- PHY 125 and 126

Students must also complete 15 prerequisite credit hours in occupational safety and health and pass these courses with a grade of C or higher.

**Prerequisite Undergraduate Requirements ................. 15 hours**

OSH 192 Introduction to Occupational Safety and Health
OSH 353 Prevention of Musculoskeletal Disorders in the Workplace
OSH 453 Human Factors in Safety Engineering
OSH 387 OSHA Standards for General Industry and Construction
OSH 420 Fundamental of Industrial Hygiene

and one of the following concentration-specific courses:
Environmental
OSH 320 Environmental and Occupational Health Engineering Technology

Safety Management
OSH 384 Construction Safety

Industrial Hygiene
OSH 425 Physical Agents

Master of Science in Occupational Safety and Health

CIP 15.0701


Within departmental guidelines, the individual student’s program is developed in consultation with advisor.

**THESIS REQUIREMENTS**

<table>
<thead>
<tr>
<th>Total Course Requirements</th>
<th>30 hours</th>
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<tbody>
<tr>
<td><strong>Technical Requirements</strong></td>
<td>12 hrs</td>
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<tr>
<td>Choose four from the following:</td>
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<tr>
<td>OSH 621 Industrial Hygiene and Safety Program Development</td>
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<td>OSH 623 Occupational Diseases</td>
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<tr>
<td>OSH 626 Industrial Hygiene Sampling Strategies</td>
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<td>OSH 630 Global Issues in OSH</td>
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<td>OSH 636 Transportation Management</td>
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<td>OSH 637 Biostatistics and Probability</td>
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<td>OSH 640 Safety and Health Program Management and Training</td>
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<td>OSH 645 Loss Control Measurement and Management</td>
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<td>OSH 646 Fundamentals of Risk Control</td>
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<td>OSH 654 Advanced Safety and Health Management and Administration</td>
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<td>OSH 655 Legal Aspects of Safety and Health</td>
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<td>OSH 656 Ergonomics and Biomechanics</td>
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<tr>
<td>OSH 658 Introduction to Occupational Epidemiology</td>
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<tr>
<td>OSH 644 Cooperative Education(^1) (or approved elective with prior safety internship or equivalent)</td>
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<tr>
<td>OSH 680 Graduate Seminar in Occupational Safety and Health</td>
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<tr>
<td>OSH 697 Research in Environmental Health and Safety</td>
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<tr>
<td><strong>Thesis</strong></td>
<td>6 hrs</td>
</tr>
<tr>
<td>OSH 698-699 Thesis</td>
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</tbody>
</table>

\(^1\)Technical requirements courses are selected based on the student’s program concentration and must be approved by the graduate program advisor.

**NON-THESIS REQUIREMENTS**

<table>
<thead>
<tr>
<th>Total Course Requirements</th>
<th>30 hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Same as above with the following substitution for thesis:</td>
<td></td>
</tr>
<tr>
<td>OSH 644 Cooperative Education(^1) (or approved elective with prior safety internship or equivalent)</td>
<td></td>
</tr>
<tr>
<td>OSH 680 Graduate Seminar in Occupational Safety and Health</td>
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</tr>
</tbody>
</table>

All students (Thesis or Non-Thesis) must also complete 12 credit hours by selecting one of the following three concentrations. Substitutions within these concentrations can be made only with the approval of the advisor. Consult with advisor when choosing a concentration. Additional coursework may be required.

**Safety Management Concentration** | 12 hrs |
| OSH 621 Industrial Hygiene and Safety Program Development |
| OSH 650 Occupational Safety and Health Organizational Leadership and Management |
| OSH 655 Legal Aspects of Safety and Health |
| OSH 657 Current Literature and Research in Safety and Health\(^1\) |
Industrial Hygiene Concentration .................................. 12 hrs
OSH  621  Industrial Hygiene and Safety Program Development
OSH  622  Toxicology of Industrial Materials
OSH  627  Air Contaminants and Industrial Ventilation
OSH  663  Applied Workplace Ergonomics

Environmental Concentration ........................................ 12 hrs
OSH  627  Air Contaminants and Industrial Ventilation
OSH  687  Wastewater Treatment
OSH  689  Solid and Hazardous Waste Treatment
OSH  697  Research in Environmental Health and Safety

Other Degree Requirements
• Oral defense of thesis (Thesis track).
• Students with no adequate undergraduate statistics preparation must take OSH 637.