



# College of Science, Engineering and Technology

Neil Weber, Dean

Robert Pervine, Assistant Dean

201 Collins Center

270-809-3391



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The departments in the College of Science, Engineering and Technology have a proud history of preparing students for careers in biology, chemistry, geosciences, mathematics, statistics, industrial technology, engineering technology, telecommunications, graphic communications, engineering and physics. The programs of the College are exceptionally strong because of our talented, dedicated, student-oriented faculty.

The college's faculty are recognized scholars whose state-of-the-art interdisciplinary research is funded by agencies such as the National Institutes of Health, the National Science Foundation, the Environmental Protection Agency, the Department of Homeland Security, and the Department of Energy. 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. It is our belief that students learn science, mathematics, engineering, and technology best by doing REAL work in these areas. To this end, some 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.

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.

There is little question that our academic program is different from those you will find at many universities. It is because of this difference that the College of Science, Engineering and Technology and Murray State University have received funding from the state of Kentucky to build a new \$50 million science complex.

Our faculty are here to assist all our students, providing extra challenge or extra help as needed. The College's legacy of offering the very best in undergraduate and graduate instruction continues to be our top priority. Our faculty continuously review and revise our curricula to help ensure that our programs are preparing all our students for today and tomorrow's careers.

Associate degree programs in the college are closely related to the Kentucky Tech Prep education initiative. Graduates and transfer students from technical, community and junior colleges are invited to continue their education in our upper-division baccalaureate degree programs.

## Programs and Facilities

**Program of Distinction in Telecommunication Systems Management.** The telecommunications field, which incorporates systems and 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.

**Center of Excellence for Reservoir Research.** 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 Center: the Hancock Biological Station (HBS), the Mid-America Remote sensing Center (MARC), and the Chemical Analysis Laboratory (CAL). The Center's primary research focus is long-term reservoir studies, principally on Kentucky and Barkley lakes. Center expertise is also available for analyzing environmental problems associated with other ecosystems in the region.

The Center for Reservoir Research provides outstanding research opportunities for scientists from around the world to study the region's unique environment. The Center 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 1970's when Murray State was declared the official NASA Landsat technology transfer agent, the Mid-America Remote sensing Center has distinguished itself as the premier remote sensing/geographic information center for the Commonwealth of Kentucky. MARC associates have educated students from all over the world in applications of space-age technology. In addition, MARC faculty and staff, using state-of-the-art image processing hardware and software, have conducted numerous resource management projects throughout the region for government as well as private sector groups. MARC also serves as a "clearinghouse" for geographically referenceable data bases for the Center of Excellence, with MARC associates coordinating the design and implementation of an interactive automated geographic information system (GIS) for Kentucky Lake and its surrounding environments.

**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 Center of Excellence for Reservoir

Research 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 Analysis Laboratory.** The Chemical Analysis Laboratory is equipped with state-of-the-art instrumentation enabling high-quality instruction in environmental analytical chemistry at both the undergraduate and graduate levels. The Chemical Analysis Laboratory is a major contributor to the Center of Excellence research through its provision of chemical analyses for environmental chemistry, ecotoxicological, trace element and acid deposition studies. In addition, it offers regional laboratory service for industries, institutions and individuals in west Kentucky, the greater Ohio Valley region and beyond in fulfillment of its regional economic service role.

The College of Science, Engineering and Technology enjoys excellent facilities in the Martha Layne Collins Center, Hugh L. Oakley Applied Science Building, Blackburn Science Building, the Biological Sciences Building which opened in 2004, and several off-campus sites. Also, the Commonwealth of Kentucky has approved the funding for a new chemistry building, currently under construction, and a new engineering and physics building, currently in the design phase.

### Pre-Professional Programs

Students planning to pursue the following professions should consult with the appropriate advisor before beginning their studies.

- **Dentistry:** Dr. Timothy Johnston, Department of Biological Sciences, and Dr. Ricky Cox, Department of Chemistry.
- **Engineering:** Dr. Stephen Cobb, Professional Engineer, Department of Physics and Engineering; Dr. Mike Kemp, Professional Engineer, Department of Industrial and Engineering Technology.
- **Forensics:** Dr. Daniel Johnson, Department of Chemistry.
- **Medicine:** Dr. Sterling Wright, Department of Biological Sciences; and Dr. Ricky Cox, Dr. Kevin Revell, and Dr. Robert Volp, Department of Chemistry.
- **Optometry:** Dr. David Canning and Dr. Tom Timmons, Department of Biological Sciences.
- **Pharmacy:** Dr. Leon Duobinis-Gray, Department of Biological Sciences; Dr. David Owen, Dr. Harry Fannin, and Dr. Edie Banner, Department of Chemistry.
- **Physical Therapy:** Dr. Terry Derting and Dr. Claire Fuller, Department of Biological Sciences.

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## Department of Biological Sciences

### 334 Blackburn Science Building

270-809-2786

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**Chair:** Tom J. Timmons. **Faculty:** Canning, Derting, Duobinis-Gray, Fuller, He, Johnston, Kipphut, Martin, Nakamura, Saar, Timmons, D. White, S. White, Whiteman, Wright, Zimmerer.

The Department of Biological Sciences offers baccalaureate programs with a major in biology (pre-medicine, pre-dentistry, pre-optometry, pre-physical therapy, molecular biology, fisheries, aquatic biology and secondary certification options 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. 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 of Biological Sciences 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 Center of Excellence for Reservoir Research, dedicated to the study of Kentucky and Barkley Reservoirs.

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### MAJOR: Biology

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

**University Studies Requirements<sup>1</sup> ..... 45-48 hrs**  
(see Chapter 4, University Studies Requirements)

University Studies selections must include:

•*Science and Mathematics:*

PHY 130 General Physics I

PHY 131 General Physics I Laboratory

*or*

PHY 235 Mechanics, Heat and Wave Motion

236 Mechanics, Heat and Wave Motion Laboratory

MAT 150 Algebra and Trigonometry

*or*

MAT 250 Calculus and Analytic Geometry I

•*University Studies Electives:*

CHE 201 General College Chemistry

CHE 202 General Chemistry and Qualitative Chemistry

**Required Courses ..... 41 hrs**

BIO 099 Freshman Orientation

BIO 115 The Cellular Basis of Life

BIO 116 Biological Inquiry and Analysis

BIO 221 Zoology: Animal Form and Function

## College of Science, Engineering and Technology

BIO 222 Botany: Plant Form and Function  
BIO 330 Principles of Ecology  
BIO 333 Genetics  
BIO 499 Senior Biology Seminar  
BIO electives: 16 hrs approved by advisor, 300-level or above  
[BIO 488 and 489 will not count here<sup>2</sup>]

**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<sup>3</sup>  
CHE 215 Chemistry Laboratory<sup>3</sup>  
CHE 330 Basic Biochemistry

**Required Minor<sup>4</sup> ..... 3-21 hrs**

**Unrestricted Electives ..... 2-24 hrs**

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

<sup>1</sup>Curriculum satisfies 9-10 hours of science University Studies requirements and ten hours of University Studies electives.

<sup>2</sup>A maximum of three hours total from BIO 483, 484 and BIO 491, 492, 493, 494 may be used.

<sup>3</sup>This course does not apply toward the chemistry minor.

<sup>4</sup>Chemistry co-requirements may apply toward the requirements for a minor in chemistry.

### AREA:

#### Biology/Biomedical Sciences Option<sup>1</sup>

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

**University Studies Requirements ..... 47-53 hrs**  
(see Chapter 4, University Studies Requirements)

University Studies selections must include:

•*Science and Mathematics:*

CHE 201 General College Chemistry  
MAT 250 Calculus and Analytic Geometry I  
PHY 130 General Physics I<sup>2</sup>  
PHY 131 General Physics I Laboratory<sup>2</sup>

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

BIO 099 Freshman Orientation  
BIO 115 The Cellular Basis of Life  
BIO 116 Biological Inquiry and Analysis  
BIO 221 Zoology: Animal Form and Function<sup>2</sup>  
*or*  
BIO 222 Botany: Plant Form and Function  
BIO 290 Biomedical Research I  
BIO 300 Introductory Microbiology  
BIO 321 Cell Biology  
BIO 322 Animal Physiology  
*or*  
BIO 555 Plant 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 ..... 23 hrs**

CHE 202 General Chemistry and Qualitative Analysis<sup>2</sup>  
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<sup>2</sup>  
PHY 133 General Physics II Laboratory<sup>2</sup>

**Restricted Electives ..... 3-9 hrs**

*Choose from the following:*

BIO 320 Comparative Vertebrate Anatomy  
BIO 421 Vertebrate Histology  
BIO 501 Immunology  
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 403 Basic Physical Chemistry  
CHE 537 Experimental Biochemistry  
PHY 370 Introduction to Modern Physics

**Total Curriculum Requirements ..... 125 hrs**

<sup>1</sup>A 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, 116, 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.

<sup>2</sup>Required for area if not taken as a University Studies elective.

### MAJOR:

#### Biology/Molecular Biology Option

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

**University Studies Requirements<sup>1</sup> ..... 46-48 hrs**  
(see Chapter 4, University Studies Requirements)

University Studies selections must include:

•*Science and Mathematics:*

MAT 250 Calculus and Analytic Geometry I  
PHY 130 General Physics I  
PHY 131 General Physics I Laboratory  
*and*  
PHY 132 General Physics II  
PHY 133 General Physics II Laboratory  
*or*  
PHY 235 Mechanics, Heat and Wave Motion *and*  
236 Mechanics, Heat and Wave Motion Laboratory  
*and*  
PHY 255 Electricity, Magnetism and Light *and*  
256 Electricity, Magnetism and Light Laboratory

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

BIO 099 Freshman Orientation  
BIO 115 The Cellular Basis of Life  
BIO 116 Biological Inquiry and Analysis  
BIO 221 Zoology: Animal Form and Function  
BIO 222 Botany: Plant Form and Function  
BIO 300 Introductory Microbiology

BIO 321 Cell Biology  
 BIO 333 Genetics  
 BIO 499 Senior Biology Seminar  
 BIO 533 Molecular Genetics  
 BIO 534 Molecular Genetics Laboratory  
 BIO 537 Experimental Biochemistry  
 BIO 597 Topics in Advanced Molecular Biology

**Co-Requirements for**

**Biology/Molecular Biology Option<sup>2</sup> ..... 27 hrs**  
 CHE 201 General College Chemistry  
 CHE 202 General Chemistry and Qualitative Analysis  
 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

**Unrestricted Electives ..... 5-7 hrs**

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

<sup>1</sup>Curriculum satisfies all hours of science University Studies requirements (Section II).

<sup>2</sup>Chemistry co-requirements may fulfill the requirements for a minor in chemistry.

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**MAJOR:  
 Biology/Pre-Medical/Pre-Dental Option**

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

**University Studies Requirements<sup>1</sup> ..... 46-48 hrs**  
 (see Chapter 4, University Studies Requirements)

University Studies selections must include:

**•Science and Mathematics:**

MAT 150 Algebra and Trigonometry  
*or*  
 MAT 250 Calculus and Analytic Geometry I  
 PHY 130 General Physics I  
 PHY 131 General Physics I Laboratory  
*and*  
 PHY 132 General Physics II  
 PHY 133 General Physics II Laboratory  
*or*  
 PHY 235 Mechanics, Heat and Wave Motion *and*  
 236 Mechanics, Heat and Wave Motion Laboratory  
*and*  
 PHY 255 Electricity, Magnetism and Light *and*  
 256 Electricity, Magnetism and Light Laboratory

**•Social Sciences (recommended):**

PSY 180 General Psychology

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

BIO 099 Freshman Orientation  
 BIO 115 The Cellular Basis of Life  
 BIO 116 Biological Inquiry and Analysis  
 BIO 221 Zoology: Animal Form and Function  
 BIO 222 Botany: Plant Form and Function  
 BIO 321 Cell Biology  
 BIO 322 Animal Physiology  
 BIO 333 Genetics  
 BIO 499 Senior Biology Seminar

BIO electives: *12 hrs approved by advisor 300 level or above*  
*[BIO 488 and 489 will not count here]<sup>2</sup>*

**Co-Requirements for Biology Major ..... 18 hrs**

CHE 201 General College Chemistry  
 CHE 202 General Chemistry and Qualitative Analysis  
 CHE 312 Organic Chemistry I  
 CHE 320 Organic Chemistry II

**Required Minor<sup>3</sup> ..... 3-21 hrs**

**Unrestricted Electives<sup>4</sup> ..... 0-18 hrs**

**Total Curriculum Requirements ..... 125 hrs**

<sup>1</sup>Curriculum satisfies all hours of science University Studies requirements (Section II).

<sup>2</sup>A maximum of three hours total from BIO 483, 484 and BIO 491, 492, 493, 494 may be used.

<sup>3</sup>Chemistry co-requirements may apply toward the requirements for a minor in chemistry.

<sup>4</sup>ENG 204 strongly recommended. Electives other than ENG 204 must be at the 300 level or above.

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**MAJOR:  
 Biology/Pre-Optometry Option**

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

**University Studies Requirements ..... 46-48 hrs**  
 (see Chapter 4, University Studies Requirements)

University Studies selections must include:

**•Science and Mathematics:**

MAT 250 Calculus and Analytic Geometry I  
 PHY 130 General Physics I  
 PHY 131 General Physics I Laboratory  
*and*  
 PHY 132 General Physics II  
 PHY 133 General Physics II Laboratory  
*or*  
 PHY 235 Mechanics, Heat and Wave Motion  
 236 Mechanics, Heat and Wave Motion Laboratory  
*and*  
 PHY 255 Electricity, Magnetism and Light  
 256 Electricity, Magnetism and Light Laboratory

**•Social Sciences:**

PSY 180 General Psychology

**•University Studies Electives:**

MAT 135 Introduction to Probability and Statistics  
 CHE 201 General College Chemistry

**Required Courses ..... 41 hrs**

BIO 099 Freshman Orientation  
 BIO 115 The Cellular Basis of Life  
 BIO 116 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: *12 hrs approved by advisor 300-level or above*  
*[BIO 488 and 489 will not count here]<sup>1</sup>*

## College of Science, Engineering and Technology

### Co-Requirements for Biology/Pre-Optometry ..... 16 hrs

CHE 202 General Chemistry and Qualitative Analysis  
CHE 312 Organic Chemistry I  
CHE 320 Organic Chemistry II  
CHE 330 Basic Biochemistry  
CHE 530 Fundamentals of Biochemistry I

### Required Minor<sup>2</sup> ..... 0 hrs

### Unrestricted Electives ..... 15-17 hrs

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

<sup>1</sup>A maximum of three hours total from BIO 483, 484 and BIO 491, 492, 493, 494 may be used.

<sup>2</sup>Chemistry co-requirements may apply toward the requirements for a minor in chemistry.

## MAJOR:

### Biology/Pre-Physical Therapy Option

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

### University Studies Requirements<sup>1</sup> ..... 46 hrs (see Chapter 4, University Studies Requirements)

University Studies selections must include:

#### •Communication and Basic Skills:

COM 161 Introduction to Public Speaking

#### •Science and Mathematics:

MAT 150 Algebra and Trigonometry

or

MAT 250 Calculus and Analytic Geometry I

PHY 130 General Physics I

PHY 131 General Physics I Laboratory

and

PHY 132 General Physics II

PHY 133 General Physics II Laboratory

#### •Social Sciences:

PSY 180 General Psychology

#### •University Studies Electives:

SOC 133 Introduction to Sociology

### Required Courses ..... 39-40 hrs

BIO 099 Freshman Orientation

BIO 115 The Cellular Basis of Life

BIO 116 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

BIO 320 Comparative Vertebrate Anatomy

BIO 322 Animal Physiology

BIO 333 Genetics

BIO 499 Senior Biology Seminar

BIO electives: 4 hrs approved by advisor, 300 level or above  
[BIO 488 and 489 will not count here]<sup>2</sup>

### Co-Requirements for Biology Major and Pre-Physical Therapy ..... 27-28 hrs

CHE 201 General College Chemistry

CHE 202 General Chemistry and Qualitative Analysis

CHE 312 Organic Chemistry I

CHE 320 Organic Chemistry II

EXS 450 Exercise Physiology

MAT 135 Introduction to Probability and Statistics

or

PSY 300 Principles and Methods of Statistical Analysis

PSY 260 Lifespan Development

### Required Minor<sup>3</sup> ..... 3-21 hrs

### Unrestricted Electives ..... 0-5 hrs

### Total Curriculum Requirements ..... 120-135 hrs

<sup>1</sup>Curriculum satisfies all science University Studies requirements.

<sup>2</sup>A maximum of three hours total from BIO 483, 484 and BIO 491, 492, 493, 494 may be used.

<sup>3</sup>Chemistry co-requirements may apply toward the requirements for a minor in chemistry.

## MAJOR:

### Biology/Fisheries/Aquatic Biology Option

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

### University Studies Requirements<sup>1</sup> ..... 47 hrs (see Chapter 4, University Studies Requirements)

University Studies selections must include:

#### •Science and Mathematics:

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:

CHE 202 General Chemistry and Qualitative Analysis

MAT 135 Introduction to Probability and Statistics

### Required Biology Courses ..... 44 hrs

BIO 099 Freshman Orientation

BIO 115 The Cellular Basis of Life

BIO 116 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<sup>2</sup>

and 15 hrs selected from the following:

BIO 535 Watershed Ecology

BIO 546 Stream Ecology

BIO 547 Aquatic Vascular Plants

BIO 561 Freshwater Invertebrates

BIO 563 Aquatic Entomology

BIO 570 Ichthyology

BIO 582 Fisheries Management

BIO 587 Freshwater Biology

BIO 589 Reservoir Ecology

### Co-Requirements for Biology Major ..... 7-8 hrs and Group 1:

CHE 210 Brief Organic Chemistry<sup>3</sup>

CHE 215 Brief Organic Chemistry Laboratory<sup>3</sup>  
 CHE 330 Basic Biochemistry  
*or Group 2:*  
 CHE 312 Organic Chemistry I  
 CHE 320 Organic Chemistry II

**Required Minor<sup>4</sup> ..... 3-21 hrs**

**Unrestricted Electives ..... 0-18 hrs**

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

<sup>1</sup>Curriculum satisfies all hours of science University Studies requirements and nine hours of University Studies electives.

<sup>2</sup>Some aquatic classes are only offered as summer Hancock Biological Station courses.

<sup>3</sup>This course does not apply toward the chemistry minor.

<sup>4</sup>Chemistry co-requirements may apply toward the requirements for a minor in chemistry.

**MAJOR:**  
**Biology/Secondary Certification (Grades 8-12)**

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

**University Studies Requirements<sup>1</sup> ..... 49 hrs**  
 (see Chapter 4, University Studies Requirements)

University Studies selections must include:

•*Communication and Basic Skills:*

COM 161 Introduction to Public Speaking<sup>2</sup>

•*Science and Mathematics:*

CHE 201 General College Chemistry

CHE 202 General Chemistry and Qualitative Analysis

MAT 150 Algebra and Trigonometry

•*Social Sciences:*

EDP 260 Psychology of Human Development

•*University Studies Electives:*

EDU 103 Issues and Practices of American Education<sup>2</sup>

PHY 130 General Physics I<sup>3</sup>

PHY 131 General Physics I Laboratory<sup>3</sup>

**Note:** Certification requires a grade of B or better in one English composition course and a C 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 ..... 41 hrs**

BIO 099 Freshman Orientation

BIO 112 Field Biology

BIO 115 The Cellular Basis of Life

BIO 116 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 322 Animal Physiology

BIO 330 Principles of Ecology

BIO 333 Genetics

BIO 499 Senior Biology Seminar

**Co-Requirements for Biology Major ..... 11-12 hrs**

*Chemistry Requirement - Group 1:*

CHE 312 Organic Chemistry I

CHE 320 Organic Chemistry II

*or Group 2:*

CHE 210 Brief Organic Chemistry<sup>4</sup>

CHE 215 Brief Organic Chemistry Laboratory<sup>4</sup>

CHE 330 Basic Biochemistry

*Physics Requirement - Group 1:*

PHY 132 General Physics II<sup>5</sup>

PHY 133 General Physics II Laboratory<sup>5</sup>

**Required for Secondary Certification<sup>6</sup> ..... 29 hrs**

COM 372 Communication in Educational Environments

EDU 303 Strategies of Teaching

EDU 403 Structures and Foundations of Education

EDU 405 Evaluation and Measurement in Education

EDU 422 Student Teaching Seminar (optional)

SEC 420 Practicum in Secondary Schools

SEC 421 Student Teaching in the Secondary School

SED 300 Educating Students with Disabilities

**Required Minor<sup>7</sup> ..... 3-21 hrs**

**Total Curriculum Requirements ..... 132-151 hrs<sup>7</sup>**

<sup>1</sup>Curriculum satisfies 15 hours of science University Studies requirements.

<sup>2</sup>With a grade of C or better.

<sup>3</sup>PHY 235 and 236 will also meet this requirement.

<sup>4</sup>This course does not apply toward the chemistry minor.

<sup>5</sup>PHY 255 and 256 will also meet this requirement.

<sup>6</sup>PRAXIS Exam required during last semester before student teaching. Certification requires a grade of B or better in one English composition course and a grade of C 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.

<sup>7</sup>Chemistry co-requirements may apply toward the requirements for a minor in chemistry.

**AREA:**  
**Wildlife and Conservation Biology**

**Bachelor of Science/Bachelor of Arts Degree**  
**CIP 03.0601**

**University Studies Requirements ..... 43-48 hrs**  
 (see Chapter 4, University Studies Requirements)

University Studies selections must include:

•*Communication and Basic Skills:*

COM 161 Introduction to Public Speaking

•*Science and Mathematics:*

CHE 201 General College Chemistry

MAT 150 Algebra and Trigonometry

*or*

MAT 250 Calculus and Analytical Geometry I

PHY 130 General Physics I

PHY 131 General Physics I Laboratory

**Core Courses ..... 41-46 hrs**

BIO 099 Freshman Orientation

BIO 115 The Cellular Basis of Life

BIO 116 Biological Inquiry and Analysis

BIO 221 Zoology: Animal Form and Function

BIO 222 Botany: Plant Form and Function

BIO 330 Principles of Ecology



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**Department of Chemistry**  
**456 Blackburn Science Building**  
**270-809-2584**

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**Chair:** Judy Ratliff. **Faculty:** Anderson, Banner, Cox, Fannin, Johnson, Loganathan, McCreary, Molina, Muscio, Owen, Ratliff, Revell, Volp.

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

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 a nationally recognized chemistry student organizations, the Student Affiliates 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 Analysis Laboratory (CAL), the Center for Reservoir Research (CRR), 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, 456 Blackburn Science Building, Murray, KY 42071-3346, Phone: (270) 809-2584 Fax: (270) 809-6474. Or visit our website at [www.murraystate.edu/chemistry](http://www.murraystate.edu/chemistry)

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**AREA:**  
**Chemistry**

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**Bachelor of Science/Bachelor of Arts Degree**  
**CIP 40.0501**

ACCREDITED BY:  
 American Chemical Society

**University Studies Requirements ..... 43-48 hrs**  
 (see Chapter 4, University Studies Requirements.)

University Studies selections must include:

•*Communication and Basic Skills:*

COM 161 Introduction to Public Speaking

•*Mathematics and Science:*

MAT 250 Calculus and Analytic Geometry I<sup>1</sup>

PHY 235 Mechanics, Heat and Wave Motion<sup>1</sup>

PHY 236 Mechanics, Heat and Wave Motion Lab<sup>1</sup>

PHY 255 Electricity, Magnetism and Light<sup>1</sup>

PHY 256 Electricity, Magnetism and Light Lab<sup>1</sup>

**Required Courses ..... 58 hrs**

CHE 099 Freshman Orientation

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 410 Physical Chemistry I

CHE 420 Physical Chemistry II

CHE 511 Advanced Inorganic Chemistry I

CHE 512 Inorganic Chemistry Laboratory

CHE 519 Instrumental Analysis

CHE 530 Fundamentals of Biochemistry I

CSC 232 Visual Basic Programming I<sup>2</sup>

MAT 308 Calculus and Analytic Geometry II

MAT 309 Calculus and Analytic Geometry III

**Required Limited Electives<sup>3</sup> ..... 3 hrs**

CHE 488 Cooperative Education/Internship

or

CHE 495 Senior Research

**Unrestricted Electives ..... 16 hrs**

**Total Curriculum Requirements ..... 120-125 hrs**

<sup>1</sup>Required for area if not taken as a University Studies elective.

<sup>2</sup>PHY 140 may be substituted.

<sup>3</sup>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. option should contact the graduate coordinator in the department no later than during the junior year.

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**MAJOR:**  
**Chemistry**

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**Bachelor of Science/Bachelor of Arts Degree**  
**CIP 40.0501**

**University Studies Requirements ..... 43-48 hrs**  
 (See Chapter 4, University Studies Requirements.)

University Studies selections must include:

•*Communication and Basic Skills:*

COM 161 Introduction to Public Speaking

•*Mathematics and Science:*

MAT 250 Calculus and Analytic Geometry I<sup>1</sup>

PHY 235 Mechanics, Heat and Wave Motion<sup>1,2</sup>

PHY 236 Mechanics, Heat and Wave Motion Lab<sup>1,2</sup>

PHY 255 Electricity, Magnetism and Light<sup>1,2</sup>

PHY 256 Electricity, Magnetism and Light Lab<sup>1,2</sup>

**Required Courses ..... 49 hrs**

CHE 099 Freshman Orientation

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

## College of Science, Engineering and Technology

CHE 410 Physical Chemistry I<sup>3</sup>  
CHE 420 Physical Chemistry II<sup>3</sup>  
CSC 232 Visual Basic Programming I<sup>4</sup>  
MAT 308 Calculus and Analytic Geometry II<sup>5</sup>  
MAT 309 Calculus and Analytic Geometry III<sup>5</sup>

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

CHE 488 Cooperative Education/Internship

or

CHE 495 Senior Research

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

### Electives<sup>6,7</sup> ..... 4 hrs

### Total Curriculum Requirements ..... 120-125 hrs

<sup>1</sup>Required for major if not taken as a University Studies elective.

<sup>2</sup>PHY 130/131 and PHY 132/133 may substitute if CHE 403 is taken.

<sup>3</sup>CHE 403 and four additional hours of limited electives may substitute for CHE 410 and CHE 420.

<sup>4</sup>PHY 140 may be substituted.

<sup>5</sup>Only MAT 250 is required if CHE 403 is taken.

<sup>6</sup>Eleven hours if CHE 403 is taken.

<sup>7</sup>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)

#### 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 ..... 43-48 hrs

(See Chapter 4, University Studies Requirements.)

University Studies selections must include:

•*Communication and Basic Skills:*

COM 161 Introduction to Public Speaking

•*Mathematics and Science:*

MAT 250 Calculus and Analytic Geometry

PHY 130 General Physics I<sup>1</sup> and

PHY 131 General Physics I Laboratory<sup>1</sup>

PHY 132 General Physics II<sup>1</sup> and

PHY 133 General Physics II Laboratory<sup>1</sup>

•*Social Sciences:*

EDP 260 Psychology of Human Development<sup>2</sup>

•*University Studies Electives:*

CSC 199 Introduction to Information Technology<sup>3,4</sup>

EDU 103 Issues and Practices of American Education<sup>2,3</sup>

**Note:** Certification requires a grade of *B* or better in one English composition course and a *C* 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 ..... 33 hrs

CHE 099 Freshman Orientation

CHE 120 Chemical Laboratory Safety

CHE 201 General College Chemistry

CHE 202 General Chemistry and Qualitative Analysis

CHE 303 Strategies of Teaching Chemistry

CHE 305 Analytical Chemistry

CHE 312 Organic Chemistry I

CHE 320 Organic Chemistry II

CHE 403 Basic Physical Chemistry

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

*Select from the following:*

CHE 330 Basic Biochemistry

CHE 352 Basic Chemical Instrumentation

CHE 502 Fundamentals of Toxicology

CHE 513 Environmental Chemistry

### Secondary Certification Courses ..... 26 hrs

COM 372 Communication in Educational Environments

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

SED 300 Educating Students with Disabilities

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

### Total Curriculum Requirements ..... 126-131 hrs

<sup>1</sup>Students pursuing a Physics minor may substitute PHY 235/236 and 255/256 for PHY 130/131 and 132/133.

<sup>2</sup>Required for secondary certification if not taken as a University Studies elective.

<sup>3</sup>With a grade of C or better.

<sup>4</sup>May substitute CSC 232 or PHY 140, but these will not count for University Studies electives.

## 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 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 your 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.*

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

### Chemistry Teaching Specialization ..... 24 hrs

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**MAJOR:**  
**Chemistry/Pre-Medical/Pre-Dental Option**


---

**Bachelor of Science/Bachelor of Arts Degree**  
**CIP 40.0501**
**University Studies Requirements ..... 43-48 hrs**  
 (see Chapter 4, University Studies Requirements.)

University Studies selections must include:

**•Communication and Basic Skills:**

COM 161 Introduction to Public Speaking

**•Mathematics and Science:**

 MAT 250 Calculus and Analytic Geometry I<sup>1</sup>

 PHY 130 General Physics I<sup>1</sup>

 PHY 131 General Physics I Laboratory<sup>1</sup>

 PHY 132 General Physics II<sup>1</sup>

 PHY 133 General Physics II Laboratory<sup>1</sup>
**Required Courses ..... 36 hrs**

CHE 099 Freshman Orientation

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<sup>2</sup>

 CSC 232 Visual Basic Programming I<sup>3</sup>
**Required Limited Chemistry Electives ..... 3 hrs**
**Required Minor<sup>4</sup> ..... 21 hrs**
**Unrestricted Electives ..... 17 hrs**
**Total Curriculum Requirements ..... 120-125 hrs**
<sup>1</sup>Required for major if not taken as a University Studies elective.

<sup>2</sup>CHE 410 may substitute for CHE 403.

<sup>3</sup>PHY 140 may be substituted.

<sup>4</sup>Biology minor strongly recommended.

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**MAJOR:**  
**Chemistry/Biochemistry Option**


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**Bachelor of Science/Bachelor of Arts Degree**  
**CIP 40.0501**
**University Studies Requirements ..... 43-48 hrs**  
 (see Chapter 4, University Studies Requirements)

University Studies selections must include:

**•Communication and Basic Skills:**

COM 161 Introduction to Public Speaking

**•Mathematics and Science:**

 MAT 250 Calculus and Analytic Geometry I<sup>1</sup>

 PHY 235 Mechanics, Heat and Wave Motion<sup>1,2</sup>

 PHY 236 Mechanics, Heat and Wave Motion Lab<sup>1,2</sup>

 PHY 255 Electricity, Magnetism and Light<sup>1,2</sup>

 PHY 256 Electricity, Magnetism and Light Lab<sup>1,2</sup>
**Required Courses ..... 58 hrs**

CHE 099 Freshman Orientation

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 410 Physical Chemistry I<sup>3</sup>

 CHE 420 Physical Chemistry II<sup>3</sup>

CHE 530 Fundamentals of Biochemistry I

CHE 537 Experimental Biochemistry

CHE 540 Fundamentals of Biochemistry II

 CSC 232 Visual Basic Programming I<sup>4</sup>

 MAT 308 Calculus and Analytic Geometry II<sup>3</sup>

 MAT 309 Calculus and Analytic Geometry III<sup>3</sup>
**Required Minor<sup>5</sup> ..... 21 hrs**
**Total Curriculum Requirements ..... 122-127 hrs**
<sup>1</sup>Required for major if not taken as a University Studies elective.

<sup>2</sup>PHY 130/131 and PHY 132/133 may substitute for these courses but are not recommended.

<sup>3</sup>CHE 403 and four additional hours of limited electives may substitute for CHE 410 and CHE 420. MAT 250 only is required if CHE 403 is taken.

<sup>4</sup>PHY 140 may be substituted.

<sup>5</sup>Biology minor required, including BIO221, 222, 300, and 333; remaining courses must include 533 and 534. A biology minor must be declared, and all residential and graduation requirements met.

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**MAJOR:**  
**Chemistry/Forensics Option**


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**Bachelor of Science/Bachelor of Arts Degree**  
**CIP 40.0501**
**University Studies Requirements ..... 43-48 hrs**  
 (see Chapter 4, University Studies Requirements)

University Studies selections must include:

**•Communication and Basic Skills:**

COM 161 Introduction to Public Speaking

**•Mathematics and Science:**

MAT 250 Calculus and Analytic Geometry I

 PHY 130 General Physics I<sup>1</sup> and

 PHY 131 General Physics I Laboratory<sup>1</sup>

 PHY 132 General Physics II<sup>1</sup> and

 PHY 133 General Physics II Laboratory<sup>1</sup>
**Required Courses ..... 35 hrs**

CHE 099 Freshman Orientation

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 232 Visual Basic Programming I<sup>2</sup>
**Required Limited Electives ..... 10 hrs**

ARC 335 Forensic Archaeology

CHE 330 Basic Biochemistry

CHE 352 Basic Chemical Instrumentation

**Criminal Justice Minor<sup>3</sup> ..... 21 hrs**  
 CRJ 220, 333, and 346 are required selections.

## College of Science, Engineering and Technology

Unrestricted Electives ..... 11 hrs

Total Curriculum Requirements ..... 120-125 hrs

<sup>1</sup>Required for major if not taken as a University Studies elective.

<sup>2</sup>PHY 140 may be substituted.

<sup>3</sup>A second major in Criminal Justice can substitute for the minor.

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### MAJOR: Chemistry/Pre-Pharmacy Option<sup>1</sup>

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**Bachelor of Science/Bachelor of Arts Degree  
CIP 40.0501**

University Studies Requirements ..... 43-48 hrs  
(see Chapter 4, University Studies Requirements)

University Studies selections must include:

•*Communication and Basic Skills:*

COM 161 Introduction to Public Speaking

•*Mathematics and Science:*

MAT 250 Calculus and Analytic Geometry I<sup>2</sup>

PHY 130 General Physics I<sup>2</sup>

PHY 131 General Physics I Laboratory<sup>2</sup>

PHY 132 General Physics II<sup>2</sup>

PHY 133 General Physics II Laboratory<sup>2</sup>

•*Social Science:*

ECO 231 Principles of Microeconomics

Required Courses ..... 47 hrs

CHE 099 Freshman Orientation

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<sup>3</sup>

CSC 232 Visual Basic Programming I<sup>4</sup>

MAT 135 Introduction to Probability and Statistics

Biology Minor ..... 21 hrs

Complete any two of BIO 115, 116, 221 and 222. Twelve hours of electives 300 level or above (BIO 330 and 333 are highly recommended) 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 101 and 201 will not count toward this minor. Six hours must be upper-level (300 and greater) courses completed in residence at Murray State University.

Unrestricted Electives ..... 9 hrs

Total Curriculum Requirements ..... 120-125 hrs

<sup>1</sup>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. The pre-pharmacy advisor should be consulted.

<sup>2</sup>Required for major if not taken as a University Studies elective.

<sup>3</sup>CHE 410 may substitute for CHE 403.

<sup>4</sup>PHY 140 may be substituted.

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### MAJOR: Chemistry/Pre-MBA Option

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**Bachelor of Science/Bachelor of Arts Degree  
CIP 40.0501**

University Studies Requirements ..... 46-55 hrs  
(See Chapter 4, University Studies Requirements.)

University Studies selections must include:

•*Communication and Basic Skills:*

COM 161 Introduction to Public Speaking

•*Mathematics and Science:*

MAT 250 Calculus and Analytic Geometry I<sup>1</sup>

PHY 130 General Physics I<sup>1</sup>

PHY 131 General Physics I Laboratory<sup>1</sup>

PHY 132 General Physics II<sup>1</sup>

PHY 133 General Physics II Laboratory<sup>1</sup>

•*Social Sciences:*

ECO 230 Principles of Macroeconomics<sup>2</sup>

Required Courses ..... 35-36 hrs

CHE 099 Freshman Orientation

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 232 Visual Basic Programming I

or

PHY 140 Introduction to Computing Applications in  
Science and Engineering

Required Business Courses/Minor<sup>2</sup> ..... 24 hrs

ACC 200 Principles of Financial Accounting

ACC 201 Principles of Managerial Accounting

BPA 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 ..... 5-15 hrs

Total Curriculum Requirements ..... 120 hrs

<sup>1</sup>Required for major if not taken as a University Studies elective.

<sup>2</sup>Even though this program exceeds Murray State University's requirements for a business administration minor, for a business administration minor to appear on your 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, 403, 410, 420, 435, 488, 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 in residence at Murray State University.

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**Department of Engineering and Physics**  
131 Blackburn Science Building  
270-809-2993

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**Chair:** Stephen H. Cobb. **Faculty:** Cobb, Crofton, Hereford, Ieta, Kobraei, Nimmo, Pallone, Rogers, Thiede.

The undergraduate programs lead to a bachelor of arts or bachelor of science degree in engineering physics, physics, applied physics or electrical and telecommunications engineering. These curricula are designed to prepare the student for graduate or professional work in physics, engineering, teaching and related fields which require men and women with a broad basic education in physics, mathematics and the engineering sciences. The department also offers a minor in physics and a minor in engineering science.

The Engineering Physics curriculum is accredited as an engineering program by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology (EAC/ABET).

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**MAJOR:**  
**Physics**

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**Bachelor of Science/Bachelor of Arts Degree**  
**CIP 40.0801**

**University Studies Requirements** ..... 48 hrs  
(see Chapter 4, University Studies Requirements)

University Studies selections must include:

•*Communication and Basic Skills:*

COM 161 Introduction to Public Speaking

**Note:** See required courses below before selecting mathematics and science 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 099 Freshman Orientation

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 Chemistry<sup>1</sup>

CHE 202 General Chemistry and Qualitative Analysis<sup>1</sup>

CSC 420 Numerical Analysis I

or

MAT 442 Introduction to Numerical Analysis

MAT 250 Calculus and Analytic Geometry I<sup>1</sup>

MAT 308 Calculus and Analytic Geometry II<sup>1</sup>

MAT 309 Calculus and Analytic Geometry III<sup>1</sup>

MAT 411 Ordinary Differential Equations

**Required Limited Electives** ..... 3 hrs

*PHY/EGR courses numbered 300 or above.*

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

**Unrestricted Electives** ..... 10 hrs

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

<sup>1</sup>CHE 201 and 202, MAT 250, 308, and 309 fulfill University Studies requirements.

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

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**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** ..... 48 hrs  
(see Chapter 4, University Studies Requirements)

University Studies selections must include:

•*Communication and Basic Skills:*

COM 161 Introduction to Public Speaking<sup>1</sup>

•*Social Sciences:*

EDP 260 Psychology of Human Development

**Note:** Certification requires a grade of *B* or better in one English composition course and a *C* 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

EGR 140 Introduction to Computing Applications  
in Science and Engineering

EGR 240 Thermodynamics I

EGR 390 Engineering Measurements

PHY 099 Freshman Orientation

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 Chemistry<sup>2</sup>

CHE 202 General Chemistry and Qualitative Analysis<sup>2</sup>

CSC 420 Numerical Analysis I

or

MAT 442 Introduction to Numerical Analysis

MAT 250 Calculus and Analytic Geometry I<sup>2</sup>

MAT 308 Calculus and Analytic Geometry II<sup>2</sup>

MAT 309 Calculus and Analytic Geometry III<sup>2</sup>

MAT 411 Ordinary Differential Equations

**Required Limited Electives** ..... 3 hrs

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

**Required for Secondary Certification** ..... 32 hrs

COM 372 Communication in Educational Environments

EDU 103 Issues and Practices of American Education<sup>1</sup>

## College of Science, Engineering and Technology

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  
SED 300 Educating Students with Disabilities

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

**Total Curriculum Requirements ..... 142 hrs<sup>2</sup>**

<sup>1</sup>With a grade of C or better.

<sup>2</sup>CHE 201 and 202, MAT 250, 308, and 309 fulfill University Studies requirements.

### 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 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 your 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.*

AST 115 Introductory Astronomy  
AST 116 Introductory Astronomy Laboratory  
MAT 250 Calculus and Analytic Geometry I<sup>1</sup>  
MAT 308 Calculus and Analytic Geometry II<sup>2</sup>  
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 570 Introduction to Modern Physics

**Required Limited Electives ..... 9 hrs**

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

**Physics Teaching Specialization ..... 36 hrs**

<sup>1</sup>Corequisite of PHY 235.

<sup>2</sup>Corequisite of PHY 255.

### AREA:

#### Engineering Physics

**Bachelor of Science/Bachelor of Arts Degree  
CIP 14.1201**

#### ACCREDITED BY:

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

**Note:** This degree program has been approved by the Kentucky Education Professional Standards Board as an option for secondary education certification in physics. Students seeking certification via this option must complete the Engineering Physics curriculum and the courses required for secondary certification as listed above. For current informa-

tion, student should consult an advisor in the Department of Adolescent, Career and Special Education and with Teacher Education Services.<sup>1</sup>

**University Studies Requirements ..... 48 hrs**  
(see Chapter 4, University Studies Requirements)

University Studies selections must include:

**•Communication and Basic Skills:**

COM 161 Introduction to Public Speaking

**•Social Sciences:**

ECO 231 Principles of Microeconomics

**Core Courses ..... 45 hrs**

CHE 201 General College Chemistry<sup>2,3</sup>

EGR 099 Freshman Orientation

EGR 140 Introduction to Computing Applications  
in Science and Engineering

EGR 195 Methods of Engineering Physics

EGR 240 Thermodynamics I

EGR 259 Statics

EGR 264 Linear Circuits I

EGR 330 Dynamics

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 I<sup>2,3</sup>

MAT 308 Calculus and Analytic Geometry II<sup>2,3</sup>

MAT 309 Calculus and Analytic Geometry III<sup>2,3</sup>

MAT 411 Ordinary Differential Equations<sup>3</sup>

PHY 235 Mechanics, Heat and Wave Motion<sup>2</sup>

PHY 236 Mechanics, Heat and Wave Motion Laboratory<sup>2</sup>

PHY 255 Electricity, Magnetism and Light

PHY 256 Electricity, Magnetism and Light Laboratory

PHY 370 Introduction to Modern Physics

PHY 470 Optics

**Concentration Requirements ..... 27-29 hrs**

Each student must fulfill the requirements for either the Biomedical, Electrical or Mechanical Engineering Concentration.

#### Biomedical Engineering Concentration<sup>6</sup>

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

EGR 365 Linear Circuits II

EGR 375 Materials Science

MAT 135 Introduction to Probability and Statistics

Technical Electives (9 hrs)<sup>4</sup>

#### Electrical Engineering Concentration

ETE 520 Digital Signal Processing

EGR 365 Linear Circuits II

EGR 366 Analog Electronics I

EGR 378 Logic Design I

EGR 461 Electricity and Magnetism II

Technical Electives (8 hrs)<sup>4</sup>

Mathematics Depth Elective (3 hrs)<sup>3,5</sup>

#### Mechanical Engineering Concentration

EGR 344 Fluid Mechanics

EGR 346 Heat Transfer

EGR 359 Mechanics of Materials

EGR 375 Materials Science  
 ITD 102 CAD Applications  
 Technical Electives (9 hrs)<sup>4</sup>  
 Mathematics Depth Elective (3 hrs)<sup>3,5</sup>

**Unrestricted Elective<sup>7</sup> ..... 0-3 hrs**

**Total Curriculum Requirements ..... 123-132 hrs**

<sup>1</sup>Must be admitted to teacher education. See Chapter 5 for requirements.

<sup>2</sup>These courses are required and also fulfill University Studies requirements.

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

<sup>4</sup>Technical Electives are to be chosen from EGR/ETE/PHY courses, 300-level and above, or from the list of mathematics depth electives, or as approved by department chair.

<sup>5</sup>Mathematics depth electives should be courses at the 300-level and above.

<sup>6</sup>Students completing the concentration in Biomedical Engineering and intending to seek admission to medical school are encouraged to complete the following: BIO 321, 333; CHE 320 and 325.

<sup>7</sup>Students choosing the Electrical Engineering or Mechanical Engineering concentrations should complete three hours of unrestricted elective courses.

**AREA:  
 Electrical and Telecommunications Engineering**

**Bachelor of Science Degree  
 CIP 14.1001**

*Offered jointly with the University of Louisville, Speed School of Engineering. Students must meet admissions requirements of the University of Louisville, Speed School of Engineering and also those of Murray State University. See the department chair for details.*

**University Studies Requirements ..... 48 hrs**  
 (see Chapter 4, University Studies Requirements)

University Studies selections must include:

- Communication and Basic Skills:*  
 COM 161 Introduction to Public Speaking
- Social Sciences:*  
 ECO 231 Principles of Microeconomics

**Mathematics and Science Required Courses ..... 18 hrs**

- CHE 201 General College Chemistry<sup>1,2</sup>
- MAT 135 Introduction to Probability and Statistics
- MAT 250 Calculus and Analytic Geometry I<sup>1,2</sup>
- MAT 308 Calculus and Analytic Geometry II<sup>1,2</sup>
- MAT 309 Calculus and Analytic Geometry III<sup>1,2</sup>
- MAT 335 Matrix Theory and Linear Algebra
- MAT 411 Ordinary Differential Equations
- PHY 235 Mechanics, Heat and Wave Motion<sup>1,2</sup>
- PHY 236 Mechanics, Heat and Wave Motion Laboratory<sup>1,2</sup>
- PHY 255 Electricity, Magnetism and Light
- PHY 256 Electricity, Magnetism and Light Laboratory
- Discrete Mathematics Elective<sup>3</sup>

**Electrical Engineering Core Requirements ..... 49 hrs**

- EGR 140 Introduction to Computing Applications in  
 Science and Engineering
- EGR 390 Engineering Measurements

- ETE 099 Freshman Orientation
- ETE 264 Linear Circuits I
- ETE 322 Introduction to Engineering Computing Tools<sup>4</sup>
- ETE 365 Linear Circuits II
- ETE 366 Analog Electronics I
- ETE 378 Logic Design I
- ETE 420 Signals and Linear Systems<sup>4</sup>
- ETE 460 Electricity and Magnetism I
- ETE 461 Electricity and Magnetism II
- ETE 498 Senior Engineering Design I
- ETE 499 Senior Engineering Design II
- ETE 510 Computer Design<sup>4</sup>
- ETE 511 Computer Design Laboratory
- ETE 520 Digital Signal Processing<sup>4</sup>
- ETE 521 Digital Signal Processing Laboratory
- ETE 550 Communications and Modulation<sup>4</sup>
- ETE 551 Communications and Modulation Laboratory

**Required Support Courses ..... 14 hrs**

- EGR 195 Methods of Engineering Physics
- EGR 259 Statics
- EGR 330 Dynamics
- PHY 370 Introduction to Modern Physics
- Engineering Breadth Elective<sup>5</sup>

**Total Curriculum Requirements ..... 129 hrs**

<sup>1</sup>CHE 201, MAT 250, 308, 309, PHY 235 and 236 fulfill University Studies requirements.

<sup>2</sup>Required for area if not taken as University Studies elective.

<sup>3</sup>The discrete mathematics elective may be chosen from CSC 301, MAT 508, or another course approved by the department chair.

<sup>4</sup>This course may be taught by University of Louisville faculty via interactive television.

<sup>5</sup>The engineering breadth elective is three credit hours, chosen from EGR 240 or any EGR/ETE/PHY course 300-level or above.

**AREA:  
 Applied Physics**

**Bachelor of Science/Bachelor of Arts Degree  
 CIP 40.0801**

**University Studies Requirements ..... 48 hrs**  
 (see Chapter 4, University Studies Requirements)

University Studies selections must include:

- Communication and Basic Skills:*  
 COM 161 Introduction to Public Speaking

**Note:** See required courses below before selecting mathematics and science 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 099 Freshman Orientation
- 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

## College of Science, Engineering and Technology

PHY 460 Electricity and Magnetism I  
PHY 470 Optics  
PHY 530 Mechanics I

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

CHE 201 General College Chemistry<sup>1</sup>  
CHE 202 General Chemistry and Qualitative Analysis<sup>1</sup>  
CSC 420 Numerical Analysis I  
*or*  
MAT 442 Introduction to Numerical Analysis  
MAT 250 Calculus and Analytic Geometry I<sup>1</sup>  
MAT 308 Calculus and Analytic Geometry II<sup>1</sup>  
MAT 309 Calculus and Analytic Geometry III<sup>1</sup>  
MAT 411 Ordinary Differential Equations

### Technical Electives<sup>2</sup> ..... 24 hrs

### Unrestricted Electives ..... 9 hrs

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

<sup>1</sup>Required for area if not taken as University Studies elective.

<sup>2</sup>The 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 Option

#### 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 option. 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  
BPA 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

### 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 in residence at Murray State University.

### Engineering Science Minor ..... 22 hrs

EGR 240, 259, 264, and 330, plus nine additional hours of engineering-related courses approved by an advisor in the Department of Engineering and Physics. Six hours must be upper-level courses completed in residence at Murray State University.

### 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 411 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

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## Department of Geosciences

104A Wilson Hall

270-809-2591

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**Chair:** Tom Kind. **Faculty:** Cetin, Homsey, Kipphut, Leasure, Naugle, Wesler, Zhang.

An area in geoscience with options in earth science, earth science teacher certification, geoarchaeology, geographic information science, and environmental geology are provided by the department faculty. 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 Center of Excellence for Reservoir Research.

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

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### AREA:

#### Geoscience/Earth Science Option

#### Bachelor of Science Degree

CIP 40.0601

**University Studies Requirements ..... 43-48 hrs**  
(see Chapter 4, University Studies Requirements)

Recommended University Studies selection:

•*Communication and Basic Skills:*

COM 161 Introduction to Public Speaking

•*Recommended University Studies Elective:*

CSC 101 Introduction to Problem Solving Using Computers

### Required Courses ..... 47 hrs

ARC 150 Introduction to Archaeology  
AST 115 Introductory Astronomy  
AST 116 Introductory Astronomy Laboratory  
GSC 099 Freshman Orientation  
GSC 101 The Earth and the Environment<sup>1</sup>  
GSC 102 Earth through Time<sup>1</sup>  
GSC 125 Weather and Climate<sup>1</sup>

- GSC 202 Introduction to Geographic Information Sciences
- GSC 301 Understanding Scientific Communication
- GSC 303 Introduction to Water Science
- GSC 305 Map Analysis
- GSC 336 Principles of Geomorphology
- GSC 339 Field Geology
- GSC 512 Remote Sensing
- GSC 521 Geographic Information Systems

**Required Limited Electives ..... 3-4 hrs**  
 Select upper-level courses from the list of approved geology electives given under the option in environmental geology.

**Collateral requirement ..... 5 hrs**  
 MAT 150<sup>1</sup> (or above)

**Unrestricted Electives ..... 17-22 hrs**

**Total Curriculum Requirements ..... 120 hrs**  
<sup>1</sup>Will count towards University Studies Math/Science requirements.

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

**Bachelor of Science Degree**  
**CIP 40.0601**

**University Studies Requirements ..... 43-48 hrs**  
 (see Chapter 4, University Studies Requirements)

University Studies selections must include:

- Communication and Basic Skills:*
- COM 161 Introduction to Public Speaking<sup>1</sup>
- Social Sciences:*
- PSY 180 General Psychology
- University Studies Electives:*
- CSC 199 Introduction to Information Technology<sup>1</sup>
- Recommended University Studies Elective:*
- CSC 101 Introduction to Problem Solving Using Computers

**Note:** Certification requires a grade of *B* or better in one English composition course and a *C* 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 ..... 47 hrs**

- ARC 150 Introduction to Archaeology
- AST 115 Introductory Astronomy
- AST 116 Introductory Astronomy Laboratory
- GSC 099 Freshman Orientation
- GSC 101 The Earth and the Environment<sup>2</sup>
- GSC 102 Earth through Time<sup>2</sup>
- GSC 125 Weather and Climate<sup>2</sup>
- GSC 202 Introduction to Geographic Information Sciences
- GSC 301 Understanding Scientific Communication
- GSC 303 Introduction to Water Science
- GSC 305 Map Analysis
- GSC 336 Principles of Geomorphology
- GSC 339 Field Geology
- GSC 512 Remote Sensing
- GSC 521 Geographic Information Systems

**Required Limited Electives ..... 3-4 hrs**  
 Select upper-level courses from the list of approved geology electives given under the option in environmental geology, below.

**Collateral requirement ..... 5 hrs**  
 MAT 150<sup>2</sup> (or above)

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 I
- CHE 106 Introductory Chemistry II
- CHE 201 General College Chemistry
- CHE 202 General Chemistry and Qualitative Analysis

**C. Physics**

- PHY 235 Mechanics, Heat and Wave Motion  
and
- PHY 236 Mechanics, Heat and Wave Motion Laboratory
- PHY 255 Electricity, Magnetism and Light  
and
- PHY 256 Electricity, Magnetism and Light Laboratory

**Required for Secondary Certification ..... 38 hrs**

- COM 372 Communication in Educational Environments
- EDP 260 Psychology of Human Development
- EDU 103 Issues and Practices of American Education<sup>1</sup>
- EDU 303 Strategies of Teaching
- EDU 403 Structures and Foundations of Education
- EDU 405 Evaluation and Measurement in Education
- EDU 422 Student Teacher Seminar
- SEC 420 Practicum in Secondary Schools
- SEC 421 Student Teaching in the Secondary School
- SED 300 Educating Students with Disabilities

**Total Curriculum Requirements ..... 136-142 hrs**

- <sup>1</sup>With a grade of *C* or better
- <sup>2</sup>Will count towards University Studies Math/Science requirements.

**Earth Science Teaching Specialization**

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 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 a Earth Science Minor to appear on your 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.*

## College of Science, Engineering and Technology

AST 115 Introductory Astronomy  
AST 116 Introductory Astronomy Laboratory  
GSC 101 The Earth and the Environment  
GSC 102 Earth through Time  
GSC 125 Weather and Climate  
GSC 202 Introduction to Geographic Information Sciences  
GSC 303 Introduction to Water Science  
GSC 336 Principles of Geomorphology  
GSC 339 Field Geology

**Earth Science Teaching Specialization ..... 30 hrs**

### AREA:

#### Geoscience/Environmental Geology Option

**Bachelor of Science Degree  
CIP 40.0601**

**University Studies Requirements ..... 43-48 hrs**  
(see Chapter 4, University Studies Requirements)

Recommended University Studies selection:

•*Communication and Basic Skills:*

COM 161 Introduction to Public Speaking

•*Recommended University Studies Elective:*

CSC 101 Introduction to Problem Solving Using Computers

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

ARC 150 Introduction to Archaeology  
GSC 099 Freshman Orientation  
GSC 101 The Earth and the Environment<sup>1</sup>  
GSC 102 Earth through Time<sup>1</sup>  
GSC 202 Introduction to Geographic Information Sciences  
GSC 210 Hydrology  
GSC 301 Understanding Scientific Communication  
GSC 305 Map Analysis  
GSC 310 Rock and Mineral Resources  
GSC 314 Sediments, Soils and Stratigraphy  
GSC 336 Principles of Geomorphology  
GSC 512 Remote Sensing  
GSC 521 Geographic Information Systems  
GSC 560 Hydrogeology

**Required Limited Electives ..... 8-9 hrs**

(choose from the following approved electives)

ARC 300 Archaeology Method and Theory  
ARC 302 Archaeological Field Work I  
ARC 304 Archaeology Laboratory Methods  
ARC 390 Geoarchaeology  
CET 280 Plane Surveying  
GSC 303 Introduction to Water Science  
GSC 312 Introduction to Remote Sensing  
GSC 335 Landscapes of the National Parks  
GSC 339 Field Geology  
GSC 430 Crystallography and Optical Mineralogy  
GSC 431 Igneous and Metamorphic Petrology  
GSC 432 Stratigraphy and Sedimentary Petrology  
GSC 433 Structural Geology  
GSC 488 Cooperative Education/Internship  
GSC 489 Cooperative Education/Internship  
GSC 507 Land Use Planning  
GSC 522 Digital Cartography  
GSC 524 Conservation and Environmental Geology  
GSC 534 Invertebrate Paleontology

GSC 535 Watershed Ecology  
GSC 575 Field Vertebrate Paleontology  
GSC 591 Special Problems  
GSC 592 Special Problems  
GSC 593 Special Problems

**Collateral requirement ..... 5 hrs**  
MAT 150<sup>1</sup> (or above)

**Unrestricted Electives ..... 12-18 hrs**  
Board of Registration for Professional Geologists recommends the following courses to enhance performance on the Professional Geologist Examination.

CHE 105 Introductory Chemistry I

or

CHE 201 General College Chemistry

CHE 106 Introductory Chemistry II

or

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**

<sup>1</sup>Will count towards University Studies Math/Science requirements.

### AREA:

#### Geoscience/Geoarchaeology Option

**Bachelor of Science Degree  
CIP 40.0601**

**University Studies Requirements ..... 43-48 hrs**  
(see Chapter 4, University Studies Requirements)

University Studies selections must include:

•*Social Sciences*

ANT 140 Introduction to Cultural Anthropology

Recommended University Studies selection:

•*Communication and Basic Skills:*

COM 161 Introduction to Public Speaking

•*Recommended University Studies Elective:*

CSC 101 Introduction to Problem Solving Using Computers

**Required Courses ..... 48 hrs**

ARC 150 Introduction to Archaeology  
ARC 300 Archaeological Method and Theory  
ARC 304 Archaeological Laboratory Methods  
ARC 330 North American Archaeology  
ARC 390 Geoarchaeology  
GSC 099 Freshman Orientation  
GSC 101 The Earth and the Environment<sup>1</sup>  
GSC 102 Earth through Time<sup>1</sup>  
GSC 202 Introduction to Geographic Information Sciences  
GSC 301 Understanding Scientific Communication  
GSC 305 Map Analysis  
GSC 336 Principles of Geomorphology  
GSC 512 Remote Sensing  
GSC 521 Geographic Information Systems  
*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 ..... 2-3 hrs**

*(choose from the following approved electives)*

- ANT 325 Biological Anthropology
- ARC 314 Sediments, Soils and Stratigraphy
- ARC 315 Special Topics in Archaeology
- ARC 321 Ancient Civilizations
- ARC 335 Forensic Archaeology
- ARC 340 Archaeology of Africa
- ARC 350 Public Archaeology
- ARC 360 Historical Archaeology
- ARC 370 Archaeology of the Eastern Woodlands
- ARC 375 Archaeology of the Western Great Lakes
- ARC 385 Archaeology of Eastern Asia
- ARC 402 Archaeological Field Work II
- ARC 425 Advanced Archaeological Laboratory Methods
- ARC 500 Directed Studies
- ARC 510 Advanced Archaeological Field Work
- ARC 592 Historic Preservation
- ARC 598 Museum Studies
- CET 280 Plane Surveying
- GSC 310 Rock and Mineral Resources
- GSC 339 Field Geology
- GSC 380 Photogrammetry
- GSC 522 Digital Cartography

**Collateral requirement ..... 5 hrs**

MAT 150<sup>1</sup> (or above)

**Unrestricted Electives ..... 16-22 hrs**

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

<sup>1</sup>Will count towards University Studies Math/Science requirements.

**AREA:**

**Geoscience/Geographic Information Science (Geography) Option**

**Bachelor of Science Degree**

**CIP 40.0601**

**University Studies Requirements ..... 43-48 hrs**

(see Chapter 4, University Studies Requirements)

Recommended University Studies selections:

•*Communication and Basic Skills:*

COM 161 Introduction to Public Speaking

•*Recommended University Studies Elective:*

CSC 101 Introduction to Problem Solving Using Computers

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

- ARC 150 Introduction to Archaeology
- GSC 099 Freshman Orientation
- GSC 101 The Earth and the Environment<sup>1</sup>
- GSC 102 Earth through Time<sup>1</sup>
- GSC 110 World Geography
- GSC 125 Weather and Climate<sup>1</sup>
- GSC 202 Introduction to Geographic Information Sciences
- GSC 301 Understanding Scientific Communication
- GSC 305 Map Analysis
- GSC 336 Principles of Geomorphology
- GSC 507 Land Use Planning
- GSC 512 Remote Sensing
- GSC 521 Geographic Information Systems
- GSC 522 Digital Cartography

**Required Limited Electives ..... 3-4 hrs**

*(choose from the following approved electives)*

- ARC 300 Archaeology Method and Theory
- ARC 302 Archaeological Field Work I
- ARC 304 Archaeology Laboratory Methods
- ARC 360 Historical Archaeology
- GSC 210 Hydrology\*
- GSC 303 Introduction to Water Science
- GSC 312 Introduction to Remote Sensing\*
- GSC 335 Landscapes of the National Parks
- GSC 380 Photogrammetry
- GSC 488 Cooperative Education/Internship
- GSC 489 Cooperative Education/Internship
- GSC 523 Problems in Urban Geography and Urban Planning
- GSC 524 Conservation and Environmental Geosciences
- GSC 535 Watershed Ecology
- GSC 560 Hydrogeology
- GSC 570 Computer Applications in Geosciences
- GSC 580 Advanced Geographic Information Systems
- GSC 591 Special Problems
- GSC 592 Special Problems
- GSC 593 Special Problems

\*Recommended courses

**Collateral requirement ..... 5 hrs**

MAT 150<sup>1</sup> (or above)

**Unrestricted Electives ..... 17-23 hrs**

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

<sup>1</sup>Will count towards University Studies Math/Science requirements.

**Anthropology Minor ..... 21 hrs**

ANT 140, ARC 150, plus 15 hours of electives as approved by advisor. Electives may include up to nine hours of sociology. Six hours must be upper-level courses completed in residence at Murray State University.

**Archaeology Minor ..... 21 hrs**

ARC 150, 300, 304; ARC/GSC 390, minimum of three hours of 302, plus six to eight hours of ARC electives 300-level or above. Six hours must be upper-level courses completed in residence at Murray State University.

**Earth Science Minor ..... 25-26 hrs**

GSC 101, 102, 125, 202, 339; AST 115 and 116 or AST 215. Three additional hours of earth science coursework at the 300 level or above. Six hours must be upper-level courses completed in residence 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 in residence at Murray State University.

**Geographic Information Science (Geography) Minor .. 24 hrs**

GSC 110, 125, 202, 305, 336, and six hours of electives in geographic information science approved by the chair of the Department of Geosciences. Six hours must be upper-level courses completed in residence at Murray State University.

**Social Science Minor ..... 24 hrs**

Open only to majors in economics, geoscience (geography option),

## College of Science, Engineering and Technology

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 in residence at Murray State University.

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### Department of Industrial and Engineering Technology 263A Collins Center 270-809-3392

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**Chair:** Danny Claiborne. **Faculty:** Alsip, Benson, Claiborne, Combs, Greer, Hart, Horwood, Kellie, Kemp, Magee, Okuda, Ottway, Palmer, Schneiderman, Siebold, Tubbs, Weatherly, Whitaker, Yarali, Zirbel.

The Department of Industrial and Engineering Technology offers associate and baccalaureate programs. Also offered are a technical minor and a master of science degrees.

Graduates from the Department of Industrial and Engineering Technology are prepared to succeed in a modern industrial environment. Typical positions within industrial and engineering applications include manufacturing and processes, construction and public works, computer systems and electronic systems, graphic communications, environmental management, pollution control, telecommunications, technical sales and management. Graduates fulfill management and supervisory positions, in addition to design, maintenance, and regulatory positions.

The department supports the university mission through the following services: (1) technical education to meet the needs of MSU students; (2) programs for non-traditional students; and (3) consulting and regional service for schools, industry and government agencies.

All undergraduate programs in the department of industrial and engineering technology are required to obtain on-the-job experience. The experience can occur via cooperative work/study, internships, summer employment or other methods which fulfill program requirements.

### Engineering Technology Accreditation

The Technology Accreditation Commission of the Accreditation Board for Engineering and Technology (TAC/ABET) accredits Murray State programs in civil and construction engineering technology.

### Engineering Registration (PE)

Students in TAC/ABET accredited programs within the department are encouraged to seek professional engineering (PE) registration and are provided assistance in preparing for the fundamentals of engineering (FE) registration examination, the first phase of becoming a professional engineer. The FE examination is available to IET graduates in numerous states; however, current Kentucky law prohibits TAC/ABET program graduates from seeking registration. Therefore, individual state boards should be contacted for eligibility requirements.

## Engineering Technology

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

### •Architectural Engineering Technology

A baccalaureate degree in architectural engineering technology provides students with a background in architectural design, computer aided drafting, 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 board 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.

### •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. If the student seeks to attain professional engineering licensure, Murray State offers the first three years of a 3 + 1 civil engineering program articulated with the civil engineering program at the University of Louisville. Additionally, an associate degree in civil engineering technology may be obtained from Murray State University.

### •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.

**•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.

**•Environmental Engineering Technology**

A baccalaureate degree in environmental engineering technology provides graduates with backgrounds in municipal and industrial water and wastewater treatment system design and operations, water pollution control, solid and hazardous waste management and site remediation, industrial waste treatment and pollution prevention, air pollution control, and environmental regulatory compliance. Course work includes field and laboratory sampling and analysis plus design of pollution control systems. Depending on career goals, students are able to emphasize either environmental science or environmental health and safety in their choice of electives.

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

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**AREA: Civil Engineering Technology/  
Architectural Engineering Technology Option**

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**Bachelor of Science Degree  
CIP 15.0201**

**University Studies Requirements ..... 46-48 hrs**  
(see Chapter 4, University Studies Requirements)

University Studies selections must include:

**•Communication and Basic Skills:**

COM 161 Introduction to Public Speaking  
*or*

COM 181 Introduction to Interpersonal Communications

**•Science and Mathematics:**

CHE 105 Introductory Chemistry I

MAT 130 Technical Math I  
*or*

MAT 150 Algebra and Trigonometry

MAT 230 Technical Math II  
*or*

MAT 250 Calculus and Analytic Geometry I

**•Social Sciences:**

ECO 230 Principles of Macroeconomics

**•University Studies Electives:**

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

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 ..... 38 hrs**

CET 280 Plane Surveying

CET 298 Strength of Materials

CET 310 Anatomy of Buildings

CET 386 Building Construction Cost Estimating

ENT 099 Freshman Orientation

ENT 286 Introduction to Environmental Engineering  
Technology

ENT 287 Statics for Technology

ENT 382 Hydraulics

ENT 393 Engineering Economy

ENT 458 Applying the National Electric Code

ITD 107 Introduction to Technical Drawing and Computer  
Aided Drafting

TSM 110 Electrical Systems

**Option Courses ..... 29 hrs**

CET 385 Heavy Construction Cost Estimating

CET 481 Structural Steel Design

CET 482 Reinforced Concrete Design

ITD 204 Parametric Modeling and Rendering

ITD 301 Architectural Drawing and Residential Planning

ITD 401 Architectural Drafting & Design-Multi-Family  
Light Commercial

Technical Electives (9 hrs)

**Support Courses ..... 11-13 hrs**

ENG 324 Technical Writing

ENT 419 Senior Project I

IET 399 Professional Development Seminar I

IET 488 Cooperative Education/Internship

MAT 308 Calculus and Analytic Geometry II  
*or*

MAT 330 Technical Math III

**Total Curriculum Requirements ..... 124-128 hrs**

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**AREA: Civil Engineering Technology**

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**Bachelor of Science Degree  
CIP 15.0201**

**ACCREDITED BY:**

Technology Accreditation Commission of the Accreditation  
Board for Engineering and Technology (TAC/ABET)

**University Studies Requirements ..... 46-48 hrs**  
(see Chapter 4, University Studies Requirements)

University Studies selections must include:

**•Communication and Basic Skills:**

COM 161 Introduction to Public Speaking  
*or*

COM 181 Introduction to Interpersonal Communications

**•Science and Mathematics:**

CHE 105 Introductory Chemistry I

MAT 130 Technical Math I  
*or*

MAT 150 Algebra and Trigonometry

MAT 230 Technical Math II

**College of Science, Engineering and Technology**

*or*

MAT 250 Calculus and Analytic Geometry I

•*Social Sciences:*

ECO 230 Principles of Macroeconomics

•*University Studies Electives:*

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

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 ..... 38 hrs**

CET 280 Plane Surveying

CET 298 Strength of Materials

CET 310 Anatomy of Buildings

CET 386 Building Construction Cost Estimating

ENT 099 Freshman Orientation

ENT 286 Introduction to Environmental Engineering Technology

ENT 287 Statics for Technology

ENT 382 Hydraulics

ENT 393 Engineering Economy

ENT 458 Applying the National Electric Code

ITD 107 Introduction to Technical Drawing and Computer Aided Drafting

TSM 110 Electrical Systems

**Option Courses ..... 29 hrs**

CET 370 Intermediate Surveying

CET 481 Structural Steel Design

CET 482 Reinforced Concrete Design

CET 483 Construction Materials

CET 484 Soil Mechanics and Foundations

GSC 101 The Earth and The Environment

Technical Electives (8 hrs)

**Support Courses ..... 11-13 hrs**

ENG 324 Technical Writing

ENT 419 Senior Project I

IET 399 Professional Development Seminar I

IET 488 Cooperative Education/Internship

MAT 308 Calculus and Analytic Geometry II

*or*

MAT 330 Technical Math III

**Total Curriculum Requirements ..... 124-128 hrs**

**AREA: Civil Engineering Technology/  
Construction Engineering Technology Option**

**Bachelor of Science Degree  
CIP 15.0201**

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

**University Studies Requirements ..... 46-48 hrs**  
(see Chapter 4, University Studies Requirements)

University Studies selections must include:

•*Communication and Basic Skills:*

COM 161 Introduction to Public Speaking

*or*

COM 181 Introduction to Interpersonal Communications

•*Science and Mathematics:*

CHE 105 Introductory Chemistry I

MAT 130 Technical Math I

*or*

MAT 150 Algebra and Trigonometry

MAT 230 Technical Math II

*or*

MAT 250 Calculus and Analytic Geometry I

•*Social Sciences:*

ECO 230 Principles of Macroeconomics

•*University Studies Electives:*

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

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 ..... 38 hrs**

CET 280 Plane Surveying

CET 298 Strength of Materials

CET 310 Anatomy of Buildings

CET 386 Building Construction Cost Estimating

ENT 099 Freshman Orientation

ENT 286 Introduction to Environmental Engineering Technology

ENT 287 Statics for Technology

ENT 382 Hydraulics

ENT 393 Engineering Economy

ENT 458 Applying the National Electric Code

ITD 107 Introduction to Technical Drawing and CAD

TSM 110 Electrical Systems

**Option Courses ..... 29 hrs**

ACC 200 Principles of Financial Accounting

CET 385 Heavy Construction Cost Estimating

CET 480 Construction Planning and Management

CET 481 Structural Steel Design

*or*

CET 482 Reinforced Concrete Design

CET 483 Construction Materials

CET 484 Soil Mechanics and Foundations

LST 240 The Legal Environment of Business

MGT 350 Fundamentals of Management

OSH 287 OSHA Standards for General Industry and Construction

**Support Courses ..... 11-13 hrs**

ENG 324 Technical Writing

ENT 419 Senior Project

IET 399 Professional Development Seminar I

IET 488 Cooperative Education/Internship

MAT 308 Calculus and Analytic Geometry II

*or*

MAT 330 Technical Math III

**Total Curriculum Requirements ..... 124-128 hrs**

**ASSOCIATE:**

**Civil Engineering Technology**

**Associate of Science Degree  
CIP 15.0201**

**University Studies Requirements ..... 20 hrs**  
(see Chapter 4, University Studies Requirements)

University Studies selections must include:

•*Science and Mathematics:*

- GSC 101 The Earth and the Environment
- PHY 130 General Physics I
- PHY 131 General Physics I Laboratory

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

- CET 280 Plane Surveying
- CET 298 Strength of Materials
- CET 302 Structural Drawing
- CET 370 Intermediate Surveying
- CET 483 Construction Materials
- ENT 099 Freshman Orientation
- ENT 286 Introduction to Environmental Engineering Technology
- ENT 287 Statics for Technology
- ENT 382 Hydraulics
- ITD 107 Introduction to Technical Drawing and Computer Aided Drafting

**Support Courses ..... 24 hrs**

- CHE 105 Introductory Chemistry I
- CSC 232 Visual Basic Programming I
- ENG 324 Technical Writing
- MAT 130 Technical Math I
- MAT 230 Technical Math II
- PHY 132 General Physics II
- PHY 133 General Physics II Laboratory

**Total Curriculum Requirements ..... 76 hrs**

**CIVIL ENGINEERING 3 + 1 PROGRAM  
in articulation with the University of Louisville**

This articulation agreement enables qualified students enrolled in the civil engineering technology program in the College of Industry and Technology at Murray State University to Complete a majority of the University of Louisville Bachelor of Science in Civil Engineering (B.S.C.E.) degree program course requirements while at Murray State University. The remainder of the B.S.C.E. program requirements are to be completed at the University of Louisville with the opportunity to proceed to the master of engineering degree at that institution.

**University Studies Requirements ..... 49 hrs**  
(see Chapter 4, University Studies Requirements)

University Studies selections must include:

•*Science and Mathematics:*

- MAT 250 Calculus and Analytic Geometry I
- MAT 308 Calculus and Analytic Geometry II
- PHY 235 Mechanics, Heat and Wave Motion

•*Social Sciences:*

- ECO 230 Principles of Macroeconomics

•*University Studies Electives:*

- MAT 309 Calculus and Analytic Geometry III
- PHY 255 Electricity, Magnetism and Light

•*Additional requirement:*

- CSC 420 Numerical Analysis I

**Required Courses ..... 63 hrs**

- CET 280 Plane Surveying
- CET 298 Strength of Materials
- CET 481 Structural Steel Design
- CET 482 Reinforced Concrete Design
- CET 483 Construction Materials
- CHE 201 General College Chemistry
- ENT 099 Freshman Orientation
- ENT 287 Statics for Technology
- ENT 365 Dynamics for Technology
- GSC 101 The Earth and the Environment
- IET 371 Practicum in Technology II
- IET 380 Professional Internship I
- IET 488 Cooperative Education/Internship
- ITD 107 Introduction to Technical Drawing and Computer Aided Drafting
- MAT 335 Matrix Theory and Linear Algebra
- MAT 411 Ordinary Differential Equations
- MAT 540 Mathematical Statistics I
- PHY 236 Mechanics, Heat and Wave Motion Laboratory
- PHY 365 Linear Circuits II
- CE 360 Transportation Engineering (ITV from UofL)
- CE 370 Engineering Hydraulics (ITV from UofL)

**Required Courses at UofL ..... 28 hrs\***

- CE 201 CE Programming
- CE 320 Structural Analysis
- CE 400 Applications in CE Programming
- CE 401 CE Seminar/Professional Practice
- CE 402 Seminar in CE
- CE 420 Matrix Structural Design or
- CE 460 Transportation Systems Design
- CE 450 Geomechanics
- CE 470 Surface Water Hydrology
- CE 471 Water Supply and Sewerage
- CE 551 Foundation Engineering
- IE 570 Engineering Design Economics

**Total Curriculum Requirements ..... 140 hrs**

\*Courses with CE and IE prefixes are not Murray State University courses and are not described in this bulletin. Descriptions for these courses may be found in the *University of Louisville Undergraduate Bulletin*.

**AREA:**

**Electromechanical Engineering Technology**

**Bachelor of Science Degree  
CIP 15.0403**

**University Studies Requirements ..... 46-48 hrs**  
(see Chapter 4, University Studies Requirements)

University Studies selections must include:

•*Communication and Basic Skills:*

- COM 161 Introduction to Public Speaking

•*Science and Mathematics:*

- CHE 105 Introductory Chemistry I
- MAT 130 Technical Math I

or

- MAT 150 Algebra and Trigonometry
- MAT 230 Technical Math II

or

- MAT 250 Calculus and Analytic Geometry I

•*Social Sciences:*

**College of Science, Engineering and Technology**

- ECO 230 Principles of Macroeconomics
- University Studies Electives:*
- 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
- 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

**Required Courses ..... 57 hrs**

- CET 298 Strength of Materials
- 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 361 Introduction to Motion Controls
- EMT 455 Manufacturing Control Systems
- ENT 287 Statics for Technology
- ENT 351 Industrial and Commercial Power Distribution
- ENT 365 Dynamics for Technology
- ENT 393 Engineering Economy
- ENT 458 Applying the National Electric Code
- TSM 110 Electrical Systems I
- TSM 133 Intro to Telecom Technology and Methods
- TSM 210 Electrical Systems II
- TSM 241 Networking Fundamentals

**Support Courses ..... 17-19 hrs**

- CSC 232 Visual Basic Programming I
- ENG 324 Technical Writing
- ENT 099 Freshman Orientation
- IET 399 Professional Develop Seminar I
- IET 488 Cooperative Education/Internship
- ITD 102 CAD Applications
- MAT 308 Calculus and Analytic Geometry II
- or*
- MAT 330 Technical Math III

**Technical Electives ..... 6 hrs**

**Total Curriculum Requirements ..... 126-130 hrs**

**AREA:  
Environmental Engineering Technology**

**Bachelor of Science Degree  
CIP 15.0506**

**University Studies Requirements ..... 50 hrs**  
(see Chapter 4, University Studies Requirements)

- University Studies selections must include:
- Communication and Basic Skills:*
  - COM 161 Introduction to Public Speaking
  - or*
  - COM 181 Introduction to Interpersonal Communications
  - Science and Mathematics:*
  - CHE 105 Introductory Chemistry I
  - GSC 101 The Earth and the Environment

- MAT 130 Technical Math I
- Social Sciences:*
- ECO 140 Contemporary Economics
- or*
- ECO 230 Principles of Macroeconomics
- or*
- ECO 231 Principles of Microeconomics
- University Studies Electives:*
- CHE 106 Introduction to Chemistry II
- MAT 135 Introduction to Probability and Statistics
- MAT 230 Technical Math II

**Required Courses ..... 44 hrs**

- CET 280 Plane Surveying
- CET 341 Water Quality Technology
- CET 342 Air Quality Technology
- CET 353 Solid and Hazardous Waste Management
- CET 485 Land Use and Watershed Protection
- CET 555 Environmental Regulatory Affairs
- CET 585 Remediation Technology
- CET 587 Bioresiduals Management and Natural Wastewater Treatment Systems
- CET 589 Environmental Modeling
- ENT 099 Freshman Orientation
- ENT 286 Introduction to Environmental Engineering Technology
- ENT 382 Hydraulics
- ENT 400 Thermodynamics and Energy Development
- IET 399 Professional Development Seminar I
- IET 488 Cooperative Education/Internship
- ITD 107 Introduction to Technical Drawing and Computer Aided Drafting

**Support Courses ..... 11 hrs**

- BIO 115 The Cellular Basis of Life
- PHY 130 General Physics I
- PHY 131 General Physics I Laboratory
- PHY 132 General Physics II
- PHY 133 General Physics II Laboratory

**Area of Emphasis ..... 15 hrs**

**Environmental Science (Chosen from the following)**

- BIO 221 Zoology: Animal Form and Function
- BIO 222 Botany: Plant Form and Function
- BIO 300 Introductory Microbiology
- BIO 330 Principles of Ecology
- BIO 535 Watershed Ecology
- BIO 546 Stream Ecology
- BIO 548 Wetland Ecology
- BIO 588 Groundwater Ecosystems
- GSC 102 Earth Through Time
- GSC 210 Hydrology
- GSC 303 Introduction to Water Science
- GSC 305 Map Analysis
- GSC 507 Land Use Planning
- GSC 512 Remote Sensing
- GSC 515 Geochemistry
- GSC 521 Geographic Information Systems
- GSC 524 Conservation and Environment Geosciences
- GSC 560 Hydrogeology
- GSC 565 Biogeochemistry

**Environmental Safety & Health (Chosen from the following)**

- OSH 192 Introduction to Occupational Safety and Health
- OSH 287 OSHA Standards for General Industry and

Construction

- OSH 310 Fire & Emergency Preparedness Preplanning
- OSH 311 Hazardous Materials and Emergency Planning
- OSH 320 Environmental and Occupational Health Engineering Technology
- OSH 420 Industrial Hygiene I
- OSH 511 Hazardous Waste Site Operation
- OSH 527 Air Contaminants and Industrial Ventilation
- OSH 550 Safety and Health Program Management and Training

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

**ASSOCIATE:**

**Environmental Engineering Technology**

**Associate of Science Degree**

**CIP 15.0506**

**University Studies Requirements ..... 20 hrs**  
(see Chapter 4, University Studies Requirements)

University Studies selections must include:

•*Science and Mathematics:*

GSC 101 Earth and the Environment

•*Social Sciences:*

ECO 140 Contemporary Economics

•*University Studies Electives:*

PHY 130 General Physics I

PHY 131 General Physics I Laboratory

**Required Courses ..... 26 hrs**

- CET 280 Plane Surveying
- CET 341 Water Quality Technology
- CET 342 Air Quality Technology
- CET 353 Solid and Hazardous Waste Management
- CET 485 Land Use and Watershed Protection
- ENT 099 Freshman Orientation
- ENT 286 Introduction Environmental Engineering Technology
- ENT 382 Hydraulics
- OSH 192 Introduction to Occupational Safety and Health

**Support Courses ..... 20 hrs**

- BIO 115 The Cellular Basis of Life
- CHE 105 Introductory Chemistry I
- CHE 106 Introductory Chemistry II
- ITD 107 Introduction to Technical Drawing and Computer Aided Drafting
- MAT 130 Technical Math I

**Total Curriculum Requirements ..... 66 hrs**

**Environmental Regulatory Affairs Minor ..... 22-23 hrs**

CET 341, CET 342, CET 353, ENT 286, and 9-10 hours of limited electives selected in consultation with advisor. Prerequisite courses are not applicable to this minor. Six hours must be upper level courses completed in residence at Murray State University.

**Graphic Communications Management**

This program is designed to prepare individuals for employment at the supervisory and management levels in the printing industry.

Graduates of this program will be qualified to function as entry level managers, production planners, quality control specialists, production control expeditors, estimators, printing sales representatives, or customer service representatives.

•**Graphic Communications Technology**

This two-year program is designed to enable the student to acquire technical and professional competencies for a career in printing or related fields.

A graduate of this program may expect to qualify as an in-plant supervisor, estimator, technician, technical equipment operator, or sales or technical representative. Instruction and experience in design, management, and technical fundamentals of graphic communications are emphasized.

**AREA:**

**Graphic Communications Management**

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

**CIP 10.0302**

**University Studies Requirements ..... 44-53 hrs**  
(see Chapter 4, University Studies Requirements)

University Studies selections must include:

•*Communication and Basic Skills:*

COM 161 Introduction to Public Speaking

*or*

COM 181 Introduction to Interpersonal Communications

•*Science and Mathematics:*

CHE 105 Introductory Chemistry I

MAT 117 Mathematical Concepts

MAT 135 Introduction to Probability and Statistics

•*Social Sciences:*

ECO 140 Contemporary Economics

*or*

ECO 230 Principles of Macroeconomics

**Required Courses ..... 48 hrs**

- GCM 099 Freshman Orientation
- GCM 151 Introduction to Print Media Management
- GCM 153 Electronic Imaging
- GCM 250 Fundamentals of Photography
- GCM 252 Digital Image Conversion
- GCM 342 Finishing and Distribution
- GCM 352 Press Image Transfer I
- GCM 353 Press Image Transfer II
- GCM 354 Principles of Estimating
- GCM 365 Customer Service in Print Media
- GCM 454 Color Management and Quality Control
- GCM 556 Communications Sales Management
- ITD 492 Plant Layout and Material Handling
- IET 488 Cooperative Education/Internship
- ITD 107 Introduction to Technical Drawing and Computer Aided Drafting
- OSH elective: *approved 300-level course*

## College of Science, Engineering and Technology

### Required Limited Electives ..... 30 hrs

Select one emphasis area listed below. Course selection from multiple emphases must be approved by advisor.

#### Design

ART 101 Drawing I: Introduction to Drawing  
ART 111 Two-dimensional Design  
ART 121 Art Appreciation  
ART 350 Introduction to Graphic Design I: Digital Art  
ART 351 Graphic Design II: Type and Image  
ART 352 Graphic Design III: Layout and Introduction to Design Systems  
ART 451 Graphic Design IV: Systems Design  
Approved Technical Electives (9 hrs)

#### Photography

GCM 350 Basic Color Photography  
GCM 357 Industrial Photography  
GCM 358 Commercial Photography  
GCM 359 Publication Photography  
GCM 360 Portraiture Photography  
GCM 427 Professional Photographic Practices  
GCM 440 Electronic Digital Photography  
Approved Technical Electives (9 hrs)

#### Management <sup>1</sup>

ACC 200 Principles of Financial Accounting  
BPA 355 Information Systems and Decision Making  
CIS 343 Business Statistics II  
ECO 230 Principles of Macroeconomics <sup>2</sup>  
ECO 231 Principles of Microeconomics  
FIN 330 Principles of Finance  
LST 240 Legal Environment of Business  
MKT 360 Principles of Marketing  
Approved Technical Electives (9-12 hrs)

#### Manufacturing

EMT 261 Introduction to Fluid Power Systems  
EMT 262 Introduction to Fluid Power Systems Laboratory  
ITD 130 Manufacturing Processes and Materials  
MAT 130 Technical Math I  
TSM 110 Electrical Systems  
TSM 210 Electrical Systems II  
Approved Technical Electives (10 hrs)

### Total Curriculum Requirements ..... 124-133 hrs

<sup>1</sup>Students interested in pursuing a MBA should select the Management Emphasis. The following should be used as technical electives: ACC 201, CIS 443, and MAT 220.

<sup>2</sup>May be used as a University Studies elective.

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## ASSOCIATE:

### Graphic Communications Technology

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#### Associate of Science Degree

CIP 10.0303

### University Studies Requirements ..... 18-19 hrs

(see Chapter 4, University Studies Requirements)

### Required Courses ..... 48 hrs

ART 111 Two-Dimensional Design  
or

ITD 304 Advanced Parametric Modeling  
CSC 199 Introduction to Information Technology  
GCM 099 Freshman Orientation  
GCM 151 Introduction to Print Media Management  
GCM 152 Introduction to Digital Imaging  
GCM 252 Digital Image Conversion  
GCM 352 Press Image Transfer I  
GCM 353 Press Image Transfer II  
GCM 354 Principles of Estimating  
GCM 356 Printing Plates, Substrates, Inks and Toners  
GCM 452 Production Printing  
GCM 453 In-Plant and Small Printing Facility Management  
ITD 107 Introduction to Technical Drawing  
and Computer Aided Drafting  
JMC 168 Contemporary Mass Media  
OSY 101 Keyboarding  
Elective: 3 hrs

### Required Limited Electives ..... 6 hrs

### Total Curriculum Requirements ..... 72-73 hrs

### Graphic Communications Technology Minor ..... 21 hrs

ITD 101 and 18 hours of graphic communications technology approved by Graphic Communications Management advisor, selected from the following courses: GCM 151, 152, 153, 250, 252, 353, 354, 454, 541, 554, 556. Six hours must be upper-level courses completed in residence at Murray State University.

### Photography Minor ..... 21 hrs

GCM 151 and 18 hours of photography and graphic communications approved by Graphic Communications Management advisor, selected from the following courses: GCM 152, 250, 252, 350, 357, 358, 359, 360, 540. Six hours must be upper-level courses completed in residence at Murray State University.

### Industrial Technology and Design

The Industrial Technology Options are: Drafting and Design, Industrial Supervision, and Interior Design.

#### •Engineering Graphics and Design (Drafting 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 the articles required 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 func-

tion 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.

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**AREA:  
Engineering Graphics and Design**

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**Bachelor of Science Degree  
CIP 15.1302**

**University Studies Requirements ..... 47 hrs**  
(see Chapter 4, University Studies Requirements)

University Studies selections must include:

- Communications and Basic Skills:*
- COM 161 Introduction to Public Speaking
- Science and Mathematics:*
- CHE 105 Introductory Chemistry I
- PHY 130 General Physics I
- PHY 131 General Physics I Laboratory
- Social Sciences:*
- 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 099 Freshman Orientation
- 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 Drawing & Residential Planning
- ITD 350 Construction Systems
- MAT 130 Technical Math I
- MGT 350 Fundamentals of Management

**Required Courses ..... 37 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
- Technical Elective (3 hrs)

**Emphasis ..... 7 hrs**

*Choose one area of emphasis below:*

**Industrial/Manufacturing Design**

- IET 597 Quality Control
- ITD 403 Product and Tooling Design

**Architectural/Construction Design**

- CET 310 Anatomy of Buildings
- ITD 401 Architectural Drafting and Design-Multi-Family Light Commercial

**Total Curriculum Requirements ..... 122 hrs**

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**AREA:  
Interior Design**

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**Bachelor of Science Degree  
CIP 15.0603**

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

**University Studies Requirements ..... 45 hrs**  
(see Chapter 4, University Studies Requirements)

University Studies selections must include:

- Communications and Basic Skills:*
- COM 161 Introduction to Public Speaking
- Science and Mathematics:*
- CHE 105 Introductory Chemistry I
- MAT 135 Introduction to Probability and Statistics
- PHY 130 General Physics I
- PHY 131 General Physics I Laboratory
- Social Sciences:*
- 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*
- MAT 230 Technical Math II

**Core Courses ..... 38 hrs**

- 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

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ITD	301	Architectural Drawing and Residential Planning
ITD	350	Construction Systems
MAT	130	Technical Math I
MGT	350	Fundamentals of Management

### Required Courses ..... 37 hrs

ENG	324	Technical Writing
IET	488	Cooperative Education/Internship
ITD	221	Design in the Near Environment
ITD	251	Equipment
ITD	253	Interior Design Studio I
ITD	351	Textiles for Interior Design
ITD	352	History of Interiors I
ITD	353	Interior Design Studio II
IET	399	Professional Development Seminar I
ITD	099	Freshman Orientation
ITD	401	Architectural Drafting and Design Multi-Family Light Commercial
ITD	452	History of Interiors II
ITD	453	Contract Interiors
ITD	455	Housing for Handicapped and Elderly
ITD	458	Interior Design Market Experience
ITD	459	NCIDQ and NKBA Exam Review
RES	132	Real Estate Principles I
		Technical Elective (3 hrs)

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

## AREA: Manufacturing Technology

### Bachelor of Science Degree CIP 15.0613

### University Studies Requirements ..... 47 hrs (see Chapter 4, University Studies Requirements)

University Studies selections must include:

•*Communications and Basic Skills:*

COM 161 Introduction to Public Speaking

•*Science and Mathematics:*

CHE 105 Introductory Chemistry I  
MAT 135 Introduction to Probability and Statistics  
PHY 130 General Physics I  
PHY 131 General Physics I Laboratory

•*Social Sciences*

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	099	Freshman Orientation
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 Drawing and Residential Planning
ITD	350	Construction Systems
MAT	130	Technical Math I
MGT	350	Fundamentals of Management

### Required Courses ..... 36 hrs

EMT	261	Introduction to Fluid Power Systems
EMT	262	Introduction to Fluid Power Systems Laboratory
EMT	310	Programmable Logic Controllers
IET	597	Quality Control
ITD	202	Applied Technical Drawing
ITD	306	Engineering Graphics
ITD	330	Machine Tool Processes
ITD	492	Plant Layout and Material Handling
MGT	551	Organizational Behavior
TSM	110	Electrical Systems
		Technical Electives (3 hrs)

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

## ASSOCIATE: Industrial Technology/Industrial Option

### Associate of Science Degree CIP 15.0613

### University Studies Requirements ..... 21 hrs (see Chapter 4, University Studies Requirements)

University Studies selections must also include:

•*Science and Mathematics:*

MAT 130 Technical Math I  
PHY 130 General Physics I

•*Social Sciences:*

ECO 230 Principles of Macroeconomics

### Required Courses ..... 28 hrs

ITD	099	Freshman Orientation
ITD	101	Introduction to Design and Graphic Communications
ITD	104	Computer Aided Design
ITD	130	Manufacturing Processes and Materials
ITD	202	Applied Technical Drawing
ITD	350	Construction Systems
ITD	368	Computer-Aided Manufacturing and Robotics
TSM	110	Electrical Systems

### Support Courses ..... 21 hrs

EMT	261	Introduction to Fluid Power Systems
ITD	230	Machine Tool Processes
		Technical electives: 15 hrs

### Total Curriculum Requirements ..... 70 hrs

## ASSOCIATE: Industrial Technology/Industrial Processes Option

### Associate of Science Degree CIP 15.0603

### University Studies Requirements ..... 21 hrs (see Chapter 4, University Studies Requirements)

University Studies selections must also include:

•*Science and Mathematics:*

MAT 130 Technical Math I

PHY 130 General Physics I  
 •*Social Sciences:*  
 ECO 230 Principles of Macroeconomics

**Required Courses ..... 28 hrs**

ITD 099 Freshman Orientation  
 ITD 101 Introduction to Design and Graphic Communications  
 ITD 104 Computer Aided Design  
 ITD 130 Manufacturing Processes and Materials  
 ITD 202 Applied Technical Drawing  
 ITD 350 Construction Systems  
 ITD 368 Computer-Aided Manufacturing and Robotics  
 TSM 110 Electrical Systems

**Industrial Processes Option Courses ..... 24 hrs**

*These credits may be obtained at West Kentucky Tech by successful completion of diploma programs in any of the following areas: air conditioning, drafting/architectural drafter, electricity, electronics, machine tool technology, drafting/mechanical drafter specialist.*

**Total Curriculum Requirements ..... 73 hrs**

**Industrial and Engineering Technology Minor ..... 21 hrs**

Program must be approved by an advisor with at least six hours of courses at level 300 or above completed in residence at Murray State University.

**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 options 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 College of Business and Public Affairs and the College of Science, Engineering and Technology. These programs which are jointly administered by the two colleges (see page 57 in the College of Business and Public Affairs section) 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 ..... 46 hrs**  
 (see Chapter 4, University Studies Requirements)

University Studies selections must include:

- Communication and Basic Skills:*  
 COM 161 Introduction to Public Speaking
- Science and Mathematics:*  
 MAT 135 Introduction to Probability and Statistics  
 MAT 140 College Algebra  
 PHY 125 Brief Introductory Physics  
 PHY 126 Brief Introductory Physics Laboratory
- Social Sciences:*  
 ECO 231 Principles of Microeconomics
- University Studies Electives:*  
 CSC 199 Introduction to Information Technology

**Required Courses ..... 58 hrs**

ACC 200 Principles of Financial Accounting  
 ACC 201 Principles of Managerial Accounting  
 CIS 307 Decision Support Technologies  
 CIS 317 Principles of Information Systems Analysis and Design  
 CSC 101 Introduction to Problem Solving Using Computers  
 ECO 335 Economics and Public Policy of Telecommunications Industry  
 FIN 330 Principles of Finance  
 MGT 350 Fundamentals of Management  
 MKT 360 Principles of Marketing  
 TSM 099 Freshman Orientation  
 TSM 121 Telecommunications Electronics Principles  
 TSM 133 Telecommunications Technology and Methods  
 TSM 232 Network Operating Systems  
 TSM 233 Network Services  
 TSM 241 Networking Fundamentals  
 TSM 320 Introduction to Wireless Technology  
 TSM 343 Protocol Analysis  
 TSM 411 Network Design, Operations and Management  
 TSM 443 Telephone Technology  
 TSM 488 Cooperative Education/Internship<sup>1</sup>

**Selected Emphasis ..... 24 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, BPA, 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 421 Mobile Satellite Communications

***Network Security***

TSM 351 Principles of Information Security

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TSM 352 System Security  
TSM 353 Network Security  
TSM 441 Advanced Information Security

### System Administration

CSC 310 Database Administration  
CSC 360 Scripting Languages  
CIS 545 Enterprise Resource Planning  
TSM 530 Systems Planning

### Approved Electives

MGT 358 Entrepreneurial Business Plan Development  
MGT 443 Management of Operations and Technology  
MKT 475 Marketing Strategies in E-Commerce  
TSM 440 Information Assurance Policy and Management  
TSM 444 Wide Area Networks

**Total Curriculum Requirements ..... 128 hrs**

<sup>1</sup>Maximum of three hours Internship or Cooperative Education counts toward a degree.

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## ASSOCIATE: Telecommunications Systems Management

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**Associate of Applied Science Degree  
CIP 11. 0401**

**University Studies Requirements ..... 24 hrs**  
(see Chapter 4, University Studies Requirements)

University Studies selections must include:

•*Science and Mathematics:*

MAT 140 College Algebra  
PHY 125 Brief Introductory Physics  
PHY 126 Brief Introductory Physics Laboratory

•*Social Sciences:*

ECO 231 Principles of Microeconomics

•*University Studies Electives:*

COM 161 Introduction to Public Speaking

**Required Courses ..... 31 hrs**

ACC 200 Principles of Financial Accounting  
CSC 101 Introduction to Problem Solving Using Computers  
ECO 335 Economics and Public Policy of  
Telecommunications Industry  
TSM 099 Freshman Orientation  
TSM 121 Telecommunications Electronics Principles  
TSM 133 Telecommunications Technology and Methods  
TSM 232 Operating Systems  
TSM 233 Network Services  
TSM 241 Network Essentials and Hardware  
TSM 320 Introduction to Wireless Technology  
TSM 343 Protocol Analysis

**Electives ..... 9 hrs**

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

**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 in residence at Murray State University.

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## Department of Mathematics and Statistics 6C9 Faculty Hall 270-809-2311

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**Chair:** Donald Bennett. **Faculty:** Alverson, Bell, Bennett, Calvert, Donnelly, Edson, Fairbanks, K. Fister, R. Fister, Gibson, Hughes, Ivansic, Lewis, McCarthy, Mecklin, Patterson, Pearson, Porter, Pritchett, Roach, Thome, Yayenie, Zhang.

The objectives of the Department of Mathematics and Statistics are:

- to prepare its graduates for careers in science, business, research, industry and/or teaching;
- to continue its active involvement in the larger mathematical community through research and other scholarship;
- to provide students with the mathematical skills required for success in a wide variety of other programs within the university;
- to serve a major role in the University Studies of students; and
- to provide leadership and service in strengthening mathematics education in our service region and beyond.

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 option. 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 option in a related field. Each option 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.

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## MAJOR: Mathematics

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**Bachelor of Science/Bachelor of Arts Degree  
CIP 27.0101**

**University Studies Requirements ..... 43-48 hrs**  
(see Chapter 4, University Studies Requirements)

**Required Courses ..... 25 hrs**

MAT 099 Freshman Orientation  
MAT 250 Calculus and Analytic Geometry I<sup>1</sup>  
MAT 308 Calculus and Analytic Geometry II<sup>1</sup>  
MAT 309 Calculus and Analytic Geometry III<sup>1</sup>  
MAT 312 Mathematical Reasoning

MAT 335 Matrix Theory and Linear Algebra  
 MAT 540 Mathematical Statistics I

**Required Limited Electives ..... 15 hrs**

Five MAT courses numbered 400 or above including:

*one of the following:*

MAT 505 Abstract Algebra I  
 MAT 516 Introduction to Topology  
 MAT 525 Advanced Calculus I

*and one of the following:*

MAT 442 Introduction to Numerical Analysis  
 MAT 501 Mathematical Modeling I  
 MAT 524 Boundary Value Problems  
 MAT 541 Mathematical Statistics II

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

**Electives<sup>2</sup> ..... 11-16 hrs**

(including one course in computer science selected from a list approved by the Department of Mathematics and Statistics)

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

<sup>1</sup>May be taken as a University Studies elective.

<sup>2</sup>At least one three-hour free elective must be chosen from outside mathematics and may not be counted as a University Studies requirement.

**AREA:**

**Mathematics/Secondary Certification  
 Option (Grades 8-12)**

**Bachelor of Science/Bachelor of Arts Degree  
 CIP 27.0101**

**University Studies Requirements ..... 48-67 hrs**  
 (see Chapter 4, University Studies Requirements)

University Studies selections must include:

**•Communication and Basic Skills:**

COM 161 Introduction to Public Speaking<sup>1</sup>

**•Science and Mathematics:**

MAT 250 Calculus and Analytic Geometry I

MAT 308 Calculus and Analytic Geometry II

**•Social Sciences:**

PSY 180 General Psychology

**•University Studies Electives:**

EDP 260 Psychology of Human Development

EDU 103 Issues and Practices of American Education<sup>1</sup>

MAT 309 Calculus and Analytic Geometry III

**Note:** Certification requires a grade of *B* or better in one English composition course and a *C* 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**

CSC 145 Introduction to Programming I  
 MAT 099 Freshman Orientation  
 MAT 312 Mathematical Reasoning  
 MAT 335 Matrix Theory and Linear Algebra  
 MAT 510 Foundations of Geometry  
 MAT 540 Mathematical Statistics I  
 MAT 550 Teaching Mathematics I  
 MAT 551 Teaching Mathematics II

**Required Limited Electives ..... 18 hrs**

Nine hours of MAT courses numbered 400 or above including:

*one of the following:*

MAT 421 Introduction to Algebraic Structures  
 MAT 505 Abstract Algebra I  
 MAT 516 Introduction to Topology  
 MAT 525 Advanced Calculus I

*and one of the following:*

MAT 442 Introduction to Numerical Analysis  
 MAT 501 Mathematical Modeling I  
 MAT 524 Boundary Value Problems  
 MAT 541 Mathematical Statistics II

*and*

*an additional MAT course*

Nine hours from courses numbered 400 or above or from courses in disciplines related to the application of mathematics selected from a list approved by the Department of Mathematics and Statistics.

**Required for Secondary Certification ..... 32 hrs**

COM 372 Communication in Educational Environments  
 EDU 303 Strategies of Teaching  
 EDU 403 Structures and Foundations of Education  
 EDU 405 Evaluation and Measurement in Education  
 HEA 191 Personal Health<sup>2</sup>  
 SEC 420 Practicum in Secondary Schools  
 SEC 421 Student Teaching in the Secondary School  
 SED 300 Educating Students with Disabilities

**Total Curriculum Requirements ..... 122-141 hrs**

<sup>1</sup>With a grade of *C* or better.

<sup>2</sup>Department of Mathematics requirement.

**MAJOR:**

**Mathematics/Secondary Certification  
 (Grades 8-12)**

**Bachelor of Science/Bachelor of Arts Degree  
 CIP 27.0101**

**University Studies Requirements ..... 48-67 hrs**  
 (see Chapter 4, University Studies Requirements)

University Studies selections must include:

**•Communication and Basic Skills:**

COM 161 Introduction to Public Speaking<sup>1</sup>

**•Science and Mathematics:**

MAT 250 Calculus and Analytic Geometry I

MAT 308 Calculus and Analytic Geometry II

**•Social Sciences:**

PSY 180 General Psychology

**•University Studies Electives:**

EDP 260 Psychology of Human Development

EDU 103 Issues and Practices of American Education<sup>1</sup>

MAT 309 Calculus and Analytic Geometry III

**Note:** Certification requires a grade of *B* or better in one English composition course and a *C* 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**

CSC 145 Introduction to Programming I  
 MAT 099 Freshman Orientation

## College of Science, Engineering and Technology

MAT 312 Mathematical Reasoning  
MAT 335 Matrix Theory and Linear Algebra  
MAT 510 Foundations of Geometry  
MAT 540 Mathematical Statistics I  
MAT 550 Teaching Mathematics I

### Required Limited Electives ..... 9 hrs

MAT courses numbered 400 or above including:

*one of the following:*

MAT 421 Introduction to Algebraic Structures  
MAT 505 Abstract Algebra I  
MAT 516 Introduction to Topology  
MAT 525 Advanced Calculus I

*and one of the following:*

MAT 442 Introduction to Numerical Analysis  
MAT 501 Mathematical Modeling I  
MAT 524 Boundary Value Problems  
MAT 541 Mathematical Statistics II

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

### Required for Secondary Certification ..... 32 hrs

COM 372 Communication in Educational Environments  
EDU 303 Strategies of Teaching  
EDU 403 Structures and Foundations of Education  
EDU 405 Evaluation and Measurement in Education  
HEA 191 Personal Health<sup>2</sup>  
SEC 420 Practicum in Secondary Schools  
SEC 421 Student Teaching in the Secondary School  
SED 300 Educating Students with Disabilities

### Total Curriculum Requirements ..... 131-150 hrs

<sup>1</sup>With a grade of C or better.

<sup>2</sup>Department of Mathematics requirement.

## AREA:

### Mathematics/Applied Mathematics Option

Bachelor of Science/Bachelor of Arts Degree  
CIP 27.0101

University Studies Requirements ..... 43-48 hrs  
(see Chapter 4, University Studies Requirements)

### Required Courses ..... 31 hrs

MAT 099 Freshman Orientation  
MAT 250 Calculus and Analytic Geometry I<sup>1</sup>  
MAT 308 Calculus and Analytic Geometry II<sup>1</sup>  
MAT 309 Calculus and Analytic Geometry III<sup>1</sup>  
MAT 312 Mathematical Reasoning  
MAT 335 Matrix Theory and Linear Algebra  
MAT 411 Ordinary Differential Equations  
MAT 442 Introduction to Numerical Analysis  
MAT 540 Mathematical Statistics I

### Required Limited Electives ..... 33-36 hrs

A. Nine hours of mathematics courses numbered 400 or above<sup>2,3</sup>  
B. Two courses in computer science<sup>2</sup>  
C. 18 hours related to the application of mathematics<sup>2,3</sup>

### Unrestricted Electives ..... 5-13 hrs

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

<sup>1</sup>May be taken as a University Studies elective.

<sup>2</sup>These courses must be approved by the student's advisory committee.

<sup>3</sup>The program is very flexible. For example, possible options include, but are not limited to, an emphasis in either Biology, Chemistry, Computer Science, Geosciences, Physics, Statistics and Finance, or Actuarial Science.

## AREA:

### Mathematics/Pre-MBA Option

Bachelor of Science/Bachelor of Arts Degree  
CIP 27.0101

University Studies Requirements ..... 43-48 hrs  
(see Chapter 4, University Studies Requirements)

### Required Electives ..... 56 hrs

ACC 200 Principles of Financial Accounting  
ACC 201 Principles of Managerial Accounting  
BPA 355 Information Systems and Decision Making  
CSC 199 Introduction to Information Technology<sup>1</sup>  
ECO 230 Principles of Macroeconomics<sup>1</sup>  
ECO 231 Principles of Microeconomics<sup>1</sup>  
FIN 330 Principles of Finance  
MAT 099 Freshman Orientation  
MAT 250 Calculus and Analytic Geometry I<sup>1</sup>  
MAT 308 Calculus and Analytic Geometry II<sup>1</sup>  
MAT 309 Calculus and Analytic Geometry III<sup>1</sup>  
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 ..... 15 hrs

A. Twelve hours of mathematics courses numbered 400 or above<sup>2</sup>  
B. One course in computer science<sup>2</sup>

### Unrestricted Electives ..... 1-6 hrs

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

<sup>1</sup>May be taken as a University Studies elective.

<sup>2</sup>These courses must be approved by the student's advisory committee.

### Mathematics Minor ..... 23 hrs

MAT 250, 308, 309 and nine hours of selected mathematics courses numbered above 309 (except for 330, 399, 560). Departmental approval required. Six hours must be upper-level courses completed in residence at Murray State University.