College of Engineering
College of Sciences and Arts
School of Business and Economics
School of Forestry and Wood Products
School of Technology

Michigan Technological University
Announces Programs for the 2000-02 Academic Years

1400 Townsend Drive, Houghton, Michigan 49931-1295
Toll free 1-888-MTU-1885 or 906-487-1885
www.mtu.edu
### 2000–2001 Academic Calendar

#### Fall Semester 2000
- **August 21–27, Monday–Sunday**: Orientation
- **August 28, Monday**: Instruction begins
- **September 4, Monday**: Labor Day recess, 1 day
- **September 8, Friday, noon**: Homecoming recess begins*
- **October 6, Friday, 3:00 PM**: Classes resume
- **October 9, Monday**: Thanksgiving recess begins
- **November 17, Friday, 10:00 PM**: Midyear Commencement
- **December 18–22, Monday–Friday**: Final exam period
- **December 22, Friday, 10:00 PM**: Fall semester ends

#### Spring Semester 2001
- **January 15, Monday**: Instruction begins
- **January 15, Monday, noon**: Martin Luther King recess
- **January 16, Tuesday**: Classes resume
- **February 7, Wednesday, 10:00 PM**: Winter Carnival recess begins*
- **February 12, Monday**: Classes resume
- **March 2, Friday, 10:00 PM**: Spring break begins
- **March 12, Monday**: Classes resume
- **May 7–11, Monday–Friday**: Final exam period
- **May 11, Friday**: Spring semester ends
- **May 12, Saturday**: Commencement

#### Summer Sessions 2001
- **May 21, Monday**: Full session and session 2 begin
- **May 28, Monday**: Memorial Day recess
- **May 29, Tuesday**: Classes resume
- **June 28, Thursday**: Session 2 ends, followed by exam day(s)
- **July 2, Monday**: Session 3 begins
- **July 4, Wednesday**: Independence Day recess
- **July 5, Thursday**: Classes resume
- **August 9, Thursday**: Full session and session 3 end, followed by exam day(s)

#### 2001–2002 Academic Calendar

#### Fall Semester 2001
- **August 20–24, Monday–Friday**: Orientation
- **August 27, Monday**: Instruction begins
- **September 3, Monday**: Labor Day recess, 1 day
- **September 7, Friday noon**: Homecoming recess begins*
- **October 12, Friday, 3:00 PM**: Classes resume
- **October 15, Monday**: Thanksgiving recess begins
- **November 16, Friday, 10:00 PM**: Midyear Commencement
- **December 17–21, Monday–Friday**: Final exam period
- **December 21, Friday, 10:00 PM**: Fall semester ends

#### Spring Semester 2002
- **January 14, Monday**: Instruction begins
- **January 21, Monday noon**: Martin Luther King recess
- **January 22, Tuesday**: Classes resume
- **February 6, Wednesday, 10:00 PM**: Winter Carnival recess begins*
- **February 11, Monday**: Classes resume
- **March 1, Friday, 10:00 PM**: Spring break begins
- **March 11, Monday**: Classes resume
- **May 6–10, Monday–Friday**: Final exam period
- **May 10, Friday**: Spring semester ends
- **May 11, Saturday**: Commencement

#### Summer Session 2002
- **May 20, Monday**: Full session and session 2 begin
- **May 27, Monday**: Memorial Day recess
- **May 28, Tuesday**: Classes resume
- **June 27, Thursday**: Session 2 ends, followed by exam day(s)
- **July 1, Monday**: Session 3 begins
- **July 4, Thursday**: Independence Day recess
- **July 5, Friday**: Classes resume
- **August 8, Thursday**: Full session and session 3 end, followed by exam day(s)

*Dates subject to change pending athletic schedule*
Welcome to Michigan Tech!

I am pleased that you have chosen to join us as you continue your journey of education. This is the first undergraduate catalog under the semester system here at Michigan Technological University. The faculty and administration viewed the change to semesters as an opportunity to examine what we teach, and the result is the most comprehensive collection of educational offerings in our history.

Our main job at Michigan Tech is to prepare students to create the future. As you pursue your studies and extracurricular activities here, I encourage you to develop not only your problem-solving skills but also your creative skills.

And you can see creativity in many forms at the performances and lectures in the new Rozsa Center for the Performing Arts. I guarantee that there is something for everyone in the Great Events series and the Department of Fine Arts schedule.

You should also walk up the hill to view the new Horner and Hesterberg Halls in the U. J. Noblet Forestry Building. They are quite stunning and possess some interesting architectural details.

I hope your experience at Michigan Tech is rewarding, inspiring, and the best four (or more) years of your life!

Best wishes!

Curtis J. Tompkins
President

Michigan Technological University

Mission
We prepare students to create the future.

Vision
Michigan Tech will be a nationally prominent and internationally recognized technological university that bridges technology and business and that will meet the needs of a global and technologically rich society through excellence in undergraduate and graduate education, scholarship, and research.

Catalog Acknowledgments

Vice Provost for Instruction, Stephen H. Bowen
Staff assistant, Helene T. Hiner; secretary, Kimberly LaRonge

University Relations
William J. Curnow, Executive Director
Dennis K. Wallikainen, Director of Marketing Communications
William A. Tembreull, Director of Design and Publication Services

Undergraduate catalog editor, Marianne A. Brokaw
Design, Arlene L. Johnson; cover design, Joyell Diemer; photography, Brian D. Parmeter
Student assistants, Jamie A. Kelly, April Jefferson Sundquist

The material presented in this catalog is subject to change by the University at any time.

List of faculty members compiled as of May 1, 2000

In keeping with its responsibilities as an educational institution, Michigan Technological University is committed to a policy of affording equal opportunity to all of its employees, students, applicants for employment and applicants for admission without regard to race, religion, color, national origin, age, sex, sexual orientation, height, weight, or marital status. The University is also committed to a policy of educating and employing handicapped individuals and veterans without discrimination.

These policies are to be implemented with due regard for the relative qualifications of all involved. The Affirmative Action Officer is Sherry L. Kauppi, 207 Administration Building, Michigan Technological University, 1400 Townsend Drive, Houghton, MI 49931-1295. Telephone 906-487-3310.

MTU complies with all federal and state laws and regulations regarding discrimination, including the Americans with Disabilities Act of 1990 (ADA).
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About Michigan Technological University

Michigan Tech was founded in 1885 in the aftermath of the first mining boom in the US—the clamor for Michigan’s copper preceding the California Gold Rush by several years.

At its outset, the college trained mining and metallurgical engineers. Today, the University offers associate, bachelor’s, master’s, or doctoral degrees in the sciences, engineering, forestry, business, communication, and technology.

Michigan Tech undergraduates have the advantage of an education that emphasizes study across disciplines, team learning, and research; our graduate students receive intensive, advanced instruction and the opportunity to pursue research in a wide range of academic programs. Overall, our institution has gained world-wide attention for innovative education; our faculty strive to be mentors; our academic programs stress learning hand in hand with application; and our students learn to inquire and discover knowledge.

About Houghton, Michigan

The rigors of an education at Michigan Tech are complemented by its unique and tranquil setting. Houghton lies in the heart of upper Michigan’s scenic Keweenaw Peninsula. The campus overlooks Portage Lake, a long, winding ribbon of water that divides the Keweenaw in half. Just a few miles from campus, on either end of the Portage, lies Lake Superior, a majestic body of water.

Upper Michigan’s expansive waters and forests offer students unparalleled opportunity for outdoor recreation—hunting, fishing, backpacking, hiking, camping, boating, swimming, snowshoeing, and skiing. The University owns an eighteen-hole golf course and downhill and cross-country ski areas. It also has a full array of men’s and women’s sports programs, including Division I ice hockey.

Houghton, rated the eighth safest college town in the nation and the safest in Michigan, is part of the Houghton-Hancock twin-city center of approximately 12,000 residents. The University’s more than 6,000 students from many states and foreign countries make the area a vibrant multicultural community.

All in all, the campus and the surrounding communities provide a rich and inviting setting in Michigan’s storied northlands.
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Degree Programs at MTU

Undergraduate Degrees

Associate in Applied Science (2 year)
- Chemical Engineering Technology
- Civil Engineering Technology
- Electrical Engineering Technology
- Electromechanical Engineering Technology
- Forest Technology
- Mechanical Design Engineering Technology

Associate in Humanities (2 year)

Bachelor of Science (4 year)
- Applied Ecology and Environmental Sciences
- Applied Geophysics
- Applied Physics
- Biological Sciences
- Biomedical Engineering
- Business Administration
- Chemical Engineering
- Chemistry
- Civil Engineering
- Clinical Laboratory Science
- Computer Engineering
- Computer Science
- Economics
- Electrical Engineering
- Engineering (interdisciplinary or special focus)
- Engineering Technology
- Environmental Engineering
- Forestry
- Geological Engineering
- Geology
- Mathematics
- Mechanical Engineering
- Materials Science and Engineering
- Mining Engineering
- Physics
- Scientific and Technical Communication
- Social Sciences
- Surveying
- Wood Science

Bachelor of Arts (4 year)
- Liberal Arts
- Scientific and Technical Communication

Graduate Degrees

Master of Engineering

Master of Science
- Biological Sciences
- Chemical Engineering
- Chemistry
- Civil Engineering
- Computer Science
- Electrical Engineering
- Engineering Mechanics
- Environmental Engineering
- Environmental Engineering Science
- Environmental Policy
- Forestry
- Geological Engineering
- Geology
- Geophysics
- Industrial Archaeology
- Materials Science and Engineering
- Mathematics
- Mechanical Engineering
- Mineral Economics
- Mining Engineering
- Physics
- Rhetoric and Technical Communication

Doctor of Philosophy
- Biological Sciences
- Chemical Engineering
- Chemistry
- Civil Engineering
- Electrical Engineering
- Engineering (nondepartmental)
- Forest Science
- Geological Engineering
- Geology
- Geophysics
- Materials Science and Engineering
- Mathematical Sciences
- Mechanical Engineering-Engineering Mechanics
- Mining Engineering
- Physics
- Rhetoric and Technical Communication
Academic Programs

➢ ASSOCIATE DEGREES

➢ BACCALAUREATE DEGREES

➢ CERTIFICATES

➢ MINORS

The following pages list the requirements for all degree programs, associate and baccalaureate, as well as the requirements for certificates and minors. In addition to the degree requirements, model schedules are also shown. Remember that the model schedule is only an example. Your schedule may vary. For the most accurate and up-to-date requirements, see your advisor or department.

The University reserves the right to change the requirements for graduation as a means of keeping pace with educational, scientific, and technological developments. Changes may be applied to students already enrolled, but, in such cases, every effort will be made to give the student the benefit of the new educational program without imposing undue hardships.

Program requirements are listed in alphabetical order within groups.

Associate Degrees

Michigan Tech has a variety of two-year associate in applied science programs in the School of Technology (AS) and one two-year program in the College of Sciences and Arts (AH). Those students who wish to combine an associate degree with a baccalaureate degree should see their academic advisors.

Chemical Engineering Technology, AAS

School of Technology

The Chemical Engineering Technology degree prepares students for employment in a variety of industries including chemical processing, pulp/paper, oil refining, steel, power generation, and the pharmaceutical production. There is an accelerating trend in these industries for continuous and simultaneous improvement of financial, quality, safety, and environmental performance. This has resulted in a continuous movement toward the increased use of instrumentation and computer-based process management systems. In addition to providing a strong basis for roles in process operations, this program also prepares students to work intensively with the pilot plant facilities of the Process Simulation and Control Center (PSCC), a fully automated unit that currently consists of two advanced chemical manufacturing plants. Students have the opportunity to obtain professional certifications in a variety of specific materials-testing applications. The school also conducts testing for the national NCEC certification program.

Total Credits Required: 68

Major Requirements—55 credits

CET 1100 Intro to Computing and Technical Drawing ........................................3
CH 1100 General Chemistry .................................................................4
CMT 1100 Intro to Chemical Engineering Technology .............................4
CMT 1200 Team Skills Development .....................................................1
CMT 1300 Statistics in Process Technology .............................................1
CMT 2100 Instrumentation and Process Control ......................................3
CMT 2200 Process Operations I ..............................................................5
CMT 2300 Process Operations II ............................................................5
CMT 2400 Process Safety, Quality, and Environmental Issues ..................3
CMT 2500 Spec Topics in Chemical Engg Technology ............................3
CMT 2600 Spec Proj in Chemical Engg Technology ..................................3-6
MAT 1115 Technical Mathematics I ......................................................5
MAT 1125 Technical Mathematics II .....................................................5
MET 1540 Materials Science .................................................................3

Technical Elective (basic science or math) ..................................................3
Technical Elective to be approved by CMT faculty and will include all 2000-level
or above courses that are focused on science, engineering, or technology and
may or may not include CMT 2600.

Concentration Requirements—0 credits

Free Electives—0 credits

General Education Requirements—13 credits

UN 1001 Perspectives on Inquiry ..........................................................3
UN 1002 World Cultures ........................................................................4
UN 2001 Revisions .................................................................................3
Distribution Course ................................................................................3

Social and Behavioral Orientations—3 credits

UN 1001 Perspectives on Inquiry ..........................................................3

Chem Eng Tech Model Schedule—example only; actual schedule may vary.

1st Year Fall
CET 1100 .................................................................3
CMT 1100 .................................................................4
CMT 1200 .................................................................1
MAT 1115 .................................................................5
PH 1100 .................................................................1
UN 1001 .................................................................3

Total .................................................................17

1st Year Spring
CH 1100 .................................................................4
CMT 1300 .................................................................1
MAT 1125 .................................................................5
PH 1110 .................................................................3
UN 1002 .................................................................4

Total .................................................................17

2nd Year Fall
CMT 2200 .................................................................5
CMT 2400 .................................................................3
UN 2001 .................................................................3

Total .................................................................17

2nd Year Spring
CH 2200 .................................................................5
CMT 2600 .................................................................3
MET 1540 .................................................................3

Total .................................................................17

* Technical Elective to be approved by CMT faculty and will include all 2000-level or above
courses that are focused on science or math.

Civil Engineering Technology, AAS

School of Technology

A civil engineering technician is a professional who can carry out other proven
procedures or those procedures especially prescribed by civil engineers. The
technician works under the guidance of a civil engineer to serve as the link
between the engineer and the skilled craftspersons. Civil engineering technicians
work as inspectors and estimators, conduct field and laboratory testing of
construction materials, perform surveying duties, assist design engineers, and
can prepare specifications and drawings for engineering projects. Technicians are
proficient at using current surveying equipment, density testing devices, and
other quality-control equipment. Computers are commonly used to prepare
reports, process test data, and to prepare design drawings (AutoCAD software,
Eagle Point, etc.). Careers are available in the public sector with departments of
transportation or at the city/county level, along with private engineering
consulting firms, contractors, and construction management firms. Civil
engineering technology students have the opportunity to obtain professional
certifications in a variety of specific materials-testing applications. The school
also conducts testing for the national NCET certification program. Cooperative
education is encouraged through the program's links with state agencies,
engineering firms, and contractors.

Total Credits Required: 65

Major Requirements—55 credits

CET 1000 Public Speaking and Group Leadership ........................................1
CET 1100 Intro to Computing and Technical Drawing ....................................3
CET 1141 Fundamentals of Cemented Aggregate Mixtures ............................4
CET 2200 Soils in Construction .................................................................3
CET 2251 Surveying Software .................................................................3
CET 2265 Construction Planning, Scheduling, and Estimating .......................3

Total .................................................................65
### Electrical Engineering Technology, AAS

**School of Technology**

The Electrical Engineering Technology associate degree curriculum has a strong laboratory focus. All of the nine required EET courses have an associated laboratory component. While learning the fundamentals of electronic circuits and electronics in the classroom, the students are learning the operation and use of electronic measuring instruments in the laboratory. Students interested in the electrical, electronic, or computer fields, and who prefer applying established techniques to solve current technical problems should consider this program.

Electronic engineering technicians are employed in product evaluation and testing, power generation and transmission, instrumentation installation and calibration, and computer data acquisition and control. Work activities are generally instrumental oriented and range from research and development, production design, operation and maintenance, to applications and sales.

**Total Credits Required: 64**

**Major Requirements—54 credits**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CET 1100 Intro to Computing and Technical Drawing</td>
<td>3</td>
</tr>
<tr>
<td>EET 1111 Circuits I</td>
<td>3</td>
</tr>
<tr>
<td>EET 1112 Circuits I Laboratory</td>
<td>1</td>
</tr>
<tr>
<td>EET 2111 Circuits II</td>
<td>3</td>
</tr>
<tr>
<td>EET 2112 Circuits II Laboratory</td>
<td>1</td>
</tr>
</tbody>
</table>

**Free Electives—0 credits**

**Math/Science Elective**

**Total**

### Electromechanical Engineering Technology, AAS

**School of Technology**

Graduates of the Electromechanical Engineering Technology associate degree program are referred to as Electromechanical Engineering Technicians. The curriculum has a strong laboratory focus with the goal of understanding the use of electronics and computers to control mechanical systems. Eight of the nine required major courses have an associated laboratory component where students learn the operation and use of electronic measuring instruments and the control of mechanical systems in the laboratory. Particular attention is given to the operation of sensors in electromechanical transducers, their calibration and connection to data collection and control systems. Electromechanical engineering technicians are employed in product evaluation and testing, the electromechanical aspects of power generation, installation and calibration of transducers, and computer data acquisition and control of electromechanical systems. Work activities are generally with electrically controlled mechanical systems in areas from research and development, production design, operation and maintenance, to applications and sales.

**Total Credits Required: 64**

**Major Requirements—54 credits**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CET 1100</td>
<td>3</td>
</tr>
<tr>
<td>EET 1111</td>
<td>3</td>
</tr>
<tr>
<td>EET 1112</td>
<td>1</td>
</tr>
<tr>
<td>EET 2111</td>
<td>3</td>
</tr>
<tr>
<td>EET 2112</td>
<td>1</td>
</tr>
</tbody>
</table>

**Choose 6 credits from the following:**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CET 3141 Cemented Aggregate Mix Design</td>
<td>3</td>
</tr>
<tr>
<td>CET 3250 Structural Analysis and Design</td>
<td>3</td>
</tr>
<tr>
<td>CET 3252 Water and Wastewater Technology</td>
<td>3</td>
</tr>
<tr>
<td>CET 3270 Special Projects in Civil Engineering Technology</td>
<td>3</td>
</tr>
<tr>
<td>SU 2220 Route and Construction Surveying</td>
<td>3</td>
</tr>
</tbody>
</table>

**Concentration Requirements—0 credits**

**Free Electives—0 credits**

**General Education Requirements—10 credits**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>UN 1001 Perspectives on Inquiry</td>
<td>3</td>
</tr>
<tr>
<td>UN 1002 World Cultures</td>
<td>4</td>
</tr>
<tr>
<td>UN 2001 Revisions</td>
<td>3</td>
</tr>
</tbody>
</table>

**Co-Curricular Activities—1 unit**

Currently only PE classes qualify; units are required for graduation, but are not included in the calculation of the GPA, or in the overall credits required for the degree.

**Electrical Engg Tech Model Schedule**

<table>
<thead>
<tr>
<th>Semester</th>
<th>Courses</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st Year Fall</td>
<td>CET 100, 1115, 3980, SU 1100, UN 1001</td>
</tr>
<tr>
<td>2nd Year Fall</td>
<td>MET 2120, 1200, 2112, 2111, PH 1100</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Semester</th>
<th>Courses</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st Year Spring</td>
<td>CET 1141, 2100, PH 1110</td>
</tr>
<tr>
<td>2nd Year Spring</td>
<td>EET 2221, 2222, 2233, 2241, PH 1100</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Semester</th>
<th>Courses</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st Year Spring</td>
<td>EET 2111, 2112, 2141, 1125, UN 1002</td>
</tr>
<tr>
<td>2nd Year Spring</td>
<td>EET 2211, 2212, 2241, PH 1100, 1110</td>
</tr>
</tbody>
</table>

**Total Credits Required: 64**

**Free Electives—0 credits**

**General Education Requirements—10 credits**

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</tr>
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**Co-Curricular Activities—1 unit**

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<tbody>
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<td>EET 2221, 2222, 2233, 2241, PH 1100</td>
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</tr>
<tr>
<td>2nd Year Spring</td>
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</table>

**Total Credits Required: 64**

**Free Electives—0 credits**

**General Education Requirements—10 credits**

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**Electrical Engg Tech Model Schedule**

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</tr>
<tr>
<td>2nd Year Spring</td>
<td>EET 2211, 2212, 2241, PH 1100, 1110</td>
</tr>
</tbody>
</table>

**Total Credits Required: 64**

**Free Electives—0 credits**

**General Education Requirements—10 credits**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
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<tbody>
<tr>
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</tr>
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<td>4</td>
</tr>
<tr>
<td>UN 2001 Revisions</td>
<td>3</td>
</tr>
</tbody>
</table>

**Co-Curricular Activities—1 unit**

Currently only PE classes qualify; units are required for graduation, but are not included in the calculation of the GPA, or in the overall credits required for the degree.
Forest Technology, AAS

School of Technology

Most students enrolled in the Forest Technology program are interested in an outdoor field career preferably in a rural environment. Forest technology is the study of field techniques used in the management of forested ecosystems. Primary emphasis is placed upon field applications in the areas of forest inventory, forest treatments, land mapping techniques, procurement and product utilization. Michigan Tech offers the only forest technician program in the states of Michigan or Wisconsin recognized by the Society of American Foresters as meeting its standards for program recognition. It is one of only two universities in the country that offers AAS degree, BS degree, and graduate programs in forestry on the same campus. Graduates have also used the AAS degree in Forest Technology as a stepping stone toward a BS in business or surveying. The program allows students to step directly into field-related jobs in the area of forest inventory, forest management, timber sale administration, and wood procurement. Graduates involved in forest inventory are typically employed as clerks. In addition, many students elect to continue their education by earning a BS degree in Forestry, Business Administration, or Surveying.

ASSOCIATE DEGREE REQUIREMENTS

### Total Credits Required: 64

<table>
<thead>
<tr>
<th>Major Requirements</th>
<th>53 credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CET 1100 Intro to Computing and Technical Drawing</td>
<td>.3</td>
</tr>
<tr>
<td>CMT 1300 Statistics in Process Technology</td>
<td>.1</td>
</tr>
<tr>
<td>EET 1111 Circuits I</td>
<td>.3</td>
</tr>
<tr>
<td>EET 1112 Circuits I Laboratory</td>
<td></td>
</tr>
<tr>
<td>EET 2141 Digital Electronics &amp; Microprocessor Fundamentals</td>
<td>.4</td>
</tr>
<tr>
<td>EET 2221 Electronic Devices and Circuit Theory</td>
<td>.3</td>
</tr>
<tr>
<td>EET 2222 Electronic Devices and Circuits Laboratory</td>
<td>.1</td>
</tr>
<tr>
<td>EET 2223 Electrical Machinery</td>
<td>.4</td>
</tr>
<tr>
<td>EET 3281 Electrical Project Development and Troubleshooting</td>
<td>.3</td>
</tr>
<tr>
<td>EET 3373 Intro to Programmable Controllers</td>
<td>.3</td>
</tr>
<tr>
<td>MET 2000 Power Transmission</td>
<td>.3</td>
</tr>
<tr>
<td>MET 2100 Factory Automation</td>
<td>.4</td>
</tr>
<tr>
<td>MET 2153 Machine Tool Fundamentals and Applications</td>
<td>.2</td>
</tr>
<tr>
<td>MET 3131 Instrumentation</td>
<td>.4</td>
</tr>
<tr>
<td>MAT 1115 Technical Mathematics I</td>
<td>.5</td>
</tr>
<tr>
<td>MAT 1125 Technical Mathematics II</td>
<td>.5</td>
</tr>
<tr>
<td>PH 1100 Introductory Physics Lab I</td>
<td>.1</td>
</tr>
<tr>
<td>PH 1110 College Physics I</td>
<td>.3</td>
</tr>
</tbody>
</table>

#### Concentration Requirements—0 credits

Free Elective—1 credit

### General Education Requirements—10 credits

- **1st Year Fall**
  - UN 1001 Perspectives on Inquiry | .3 |
  - UN 1002 World Cultures | .4 |
  - UN 2001 Revisions | .3 |

- **1st Year Spring**
  - MAT 1125 | .5 |
  - MET 2000 | .3 |
  - SU 1100 Introduction to Surveying and Mapping | .2 |
  - PH 1100 | .1 |

- **Total** | .15 |

- **2nd Year Fall**
  - TFR 1115 Dendrology | .3 |
  - TFR 1134 Timber Harvesting | .3 |
  - TFR 1135 Natural Resource Mapping | .3 |
  - TFR 1235 Forest Measurements II | .4 |
  - TFR 2342 Forest Treatments II | .2 |
  - TFR 2344 Aerial Photos and Habitat Typing | .2 |

- **Total** | .16 |

### Electromechanical Engg Tech Model Schedule—example only; actual schedule may vary. Include 1 unit of co-curricular activities.

#### 1st Year Fall

- CET 1100 | .3 |
- EET 1111 | .3 |
- EET 1112 | .1 |
- MAT 1115 | .5 |
- UN 1001 | .3 |

#### 2nd Year Fall

- EET 2223 | .4 |
- MET 2000 | .3 |
- MET 2153 | .2 |
- PH 1100 | .1 |

#### Total | .18 |

### Co-Curricular Activities—1 unit

Currently only PE classes qualify; units are required for graduation, but are not included in the calculation of the GPA, or in the overall credits required for the degree.

### Total Credits Required: 66

<table>
<thead>
<tr>
<th>Major Requirements</th>
<th>56 credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BA 2700 Business Problem Solving</td>
<td>.4</td>
</tr>
<tr>
<td>MAT 1115 Technical Mathematics I</td>
<td>.5</td>
</tr>
<tr>
<td>SU 1100 Introduction to Surveying and Mapping</td>
<td>.2</td>
</tr>
<tr>
<td>TFR 1115 Dendrology</td>
<td>.3</td>
</tr>
<tr>
<td>TFR 1116 Land Measurements and Computer Basics</td>
<td>.3</td>
</tr>
<tr>
<td>TFR 1134 Forest Ecology-Soils</td>
<td>.4</td>
</tr>
<tr>
<td>TFR 1235 Forest Measurements I</td>
<td>.3</td>
</tr>
<tr>
<td>TFR 1242 Forest Treatments I</td>
<td>.3</td>
</tr>
<tr>
<td>TFR 1251 Natural Resource Mapping</td>
<td>.2</td>
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<tr>
<td>TFR 2335 Forest Measurements II</td>
<td>.4</td>
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<tr>
<td>TFR 2342 Forest Treatments II</td>
<td>.2</td>
</tr>
<tr>
<td>TFR 2344 Aerial Photos and Habitat Typing</td>
<td>.2</td>
</tr>
<tr>
<td>TFR 2361 Forest Protection</td>
<td>.3</td>
</tr>
<tr>
<td>TFR 2444 Forest Products</td>
<td>.3</td>
</tr>
<tr>
<td>TFR 2458 Forest Business Practices</td>
<td>.3</td>
</tr>
<tr>
<td>TFR 2461 Natural Resource Management &amp; Current Topics</td>
<td>.4</td>
</tr>
<tr>
<td>TFR 3370 Comprehensive Project</td>
<td>.2</td>
</tr>
</tbody>
</table>

#### Concentration Requirements—0 credits

Free Electives—0 credits

### General Education Requirements—10 credits

- **1st Year Fall**
  - UN 1001 Perspectives on Inquiry | .3 |
  - UN 1002 World Cultures | .4 |
  - UN 2001 Revisions | .3 |

- **1st Year Spring**
  - MAT 1115 Technical Mathematics I | .5 |
  - BA 2700 Business Problem Solving | .4 |

- **2nd Year Fall**
  - TFR 2345 Aerial Photos and Habitat Typing | .2 |
  - TFR 2361 Forest Protection | .3 |
  - TFR 2444 Forest Products | .3 |
  - TFR 2458 Forest Business Practices | .3 |
  - TFR 2461 Natural Resource Management & Current Topics | .4 |
  - TFR 3370 Comprehensive Project | .2 |

#### Co-Curricular Activities—1 unit

Currently only PE classes qualify; units are required for graduation, but are not included in the calculation of the GPA, or in the overall credits required for the degree.

### Forest Technology Model Schedule—example only; actual schedule may vary. Include 1 unit of co-curricular activities.

#### 1st Year Fall

- BA 1100 | .2 |
- TFR 1115 | .3 |
- TFR 1134 | .4 |
- UN 1001 | .3 |

#### Total | .15 |

#### 2nd Year Fall

- TFR 2335 | .4 |
- TFR 2342 | .2 |
- TFR 2344 | .4 |
- TFR 2345 | .2 |
- TFR 2361 | .3 |
- TFR 3370 | .1 |

#### Total | .16 |

#### Concentration Requirements—0 credits

Free Electives—0 credits

**Co-Curricular Activities—1 unit**

Currently only PE classes qualify; units are required for graduation, but are not included in the calculation of the GPA, or in the overall credits required for the degree.
Humanities, AH

College of Sciences and Arts

The associate degree program in humanities offers course work in English, modern languages, sciences, math, and social sciences. In addition to a well-rounded education, the Associate in Humanities can be the foundation for a bachelor's program.

Semester Credits Required: 67

Major Requirements—39 credits

FA 2090  Speech Communication OR
HU 2830 Introduction to Speech Communication  3

PHILOSOPHY, TECHNOLOGY, AND HUMAN VALUES  6
HU 2505 Science, Technology, and Humanities I, HU 2506 Science, Technology, and Humanities II, HU 2700 Introduction to Philosophy, HU 3700 Philosophy of Science, HU 3701 Philosophy of Technology

LITERATURE  6
HU 2501 Amer Exp in Lit I, 2502 Amer Exp in Lit II, HU 2538 Brit Exp in Lit I, 2539 Brit Exp in Lit II, 3251 Mod Masters, 3252 Lit in Tran, 3501 Medieval Lit, 3502 World Mythologies, 3504 Novels from World Lit, 3510 Amer Novel, 3512 Shakespeare I, 3513 Shakespeare II, 3540 Maj Brit Authors, 3541 Major Amer Authors, 3551 Pen Lit, 3552 Restoration & 18th Cent Lit, 3553 19th Cent Brit Lit, 3554 Contemp Brit Authors, 3555 20th Cent Brit Lit, 4542 Topics in Amer Lit

COMMUNICATION, LINGUISTICS, OR RHETORIC  6

VISUAL AND PERFORMING ARTS  3
FA 2330 Art Apprec, 2500 Music Theory I, 2520 Music Apprec, 2820 Theatre Apprec, 3330 Art Hist I, 3340 Art Hist II, 3530 Music Theory II, 3550 Hist of Jazz, 3560 Music Hist, 3800 Dramatic Lit, 3810 Ancient Theatre Hist, 3820 Amer Theatre Hist, 3830 Amer Musical Theatre, 3840 Myth & World Theatre; HU 2324 Intro to Film, HU 3324 Visual Media Analy

Social Sciences  6

Science and Mathematics  9
Include a minimum of 1 semester of lab science, 3 cr of mathematics, 3 cr in science, mathematics, or computer science

Concentration Requirements—0 credits

Free Electives—6 credits

General Education Requirements—22 credits
UN 1001  Perspectives on Inquiry  3
UN 1003  World Cultures Activities  1
Modern Language  6
UN 2001  Revisions  3
UN 2002  Institutions  3
Note: Two semesters of a single modern language (6 cr) in addition to UN 1003 World Cultures Activities (1 cr) can substitute for UN 1002.

DISTRIBUTION COURSES  6
Students must take one course each from two different lists, one that has World Cultures as a prerequisite and one that has Institutions as a prerequisite.

Co-Curricular Activities—3 units
Currently only PE classes qualify: units are required for graduation, but are not included in the calculation of the GPA, or in the overall credits required for the degree.

Humanities Model Schedule—Please see the Department of Humanities.

ASSOCIATE DEGREE REQUIREMENTS
Baccalaureate Degrees

Michigan Tech has a variety of four-year degree programs in all fields. If available, this section presents a model schedule along with the requirements for a Bachelor of Science or Arts degree (BS or BA). Some degrees also specify requirements for particular concentrations. Those students interested in obtaining dual degrees, double majors, or adding a minor or certificate to their degree program should consult their advisors.

Applied Ecology & Environmental Sciences, BS
School of Forestry and Wood Products

The BS in Applied Ecology and Environmental Sciences from Michigan Tech prepares students to address complex environmental problems posed by the use of natural resources. Students learn how to manage ecosystems while ensuring the conservation of natural resources. This program is interdisciplinary and educates students with the sociological, political, and economic facets of development, as well as the basic and applied ecological sciences. Graduates are employed by consulting firms, state and federal agencies, as well as environmental groups.

Total Credits Required: 128
Major Requirements—95 credits
BL 1040 Principles of Biology ........................................... 4
BL 2100 Principles of Biochemistry .................................... 3
BL 2160 Botany OR BL 2170 Zoology ............................... 4
BL 3400 Principles of Ecology ......................................... 3
CH 1100 General Chemistry ........................................... 4
FW 2010 Vegetation of North America ............................. 3
FW 2050 Measuring Forest Resources ............................... 3
FW 3020 Forest and Landscape Ecology ................................ 3
FW 3110 Natural Resource Policy .................................... 3
FW 3330 Soil Science ................................................. 4
FW 3360 Computer Applications in Natural Resource Management 3
FW 3410 Conservation Biology ....................................... 3
FW 3540 Remote Sensing and Geographic Info Sys ................................................. 4
FW 3610 Ornithology OR Elective .................................... 4
FW 4140 Ecosystem Modeling .......................................... 3
FW 4220 Wetlands .................................................... 4
FW 4240 Mammalogy OR Elective .................................... 4
FW 4610 Wildlife Ecology ............................................ 3
FW 4630 Isle Royale Field Ecology Camp .......................... 6
FW 4810 Integrated Resource Assessment .......................... 3
FW 4820 Integrated Resource Management .......................... 3
MA 1135 Calculus for Life Sciences ................................. 4
MA 2720 Statistical Methods ......................................... 4
Biology electives .................................................. 6
Environmental electives ............................................ 6

Concentration Requirements—0 credits
Free Electives—5 credits

General Education Requirements—28 credits
Core ................................................................. 13
UN 1001 Perspectives on Inquiry .................................... 3
UN 1002 World Cultures ............................................ 4
UN 2001 Revisions .................................................. 4
UN 2002 Institutions ................................................ 3
Note: Two semesters of a single modern language (6 cr) in addition to UN 1003 World Cultures Activities (1 cr) can substitute for UN 1002.

DISTRIBUTION COURSES .................................................. 15
Students must take two courses each from two different lists, one that has World Cultures as a prerequisite and one that has Institutions as a prerequisite. The fifth course can come from any list. See the General Education section for specific lists and allowed courses.

SCIENCE/MATH—Satisfied by major requirements above.

Co-Curricular Activities—3 units
Currently only PE classes qualify; units are required for graduation, but are not included in the calculation of the GPA, or in the overall credits required for the degree.

Applied Ecology Model Schedule—example only; actual schedule may vary.
Include 3 units of co-curricular activities.

1st Year Fall
BL 1040 .............................................. 4
FW 2010 .............................................. 4
FW 2050 .............................................. 3
FW 3360 .............................................. 3
UN 1001 .............................................. 3
Total .................................................. 17

1st Year Spring
BL 2160 OR BL 2170 ........................................ 4
CH 1100 .............................................. 4
MA 1135 .............................................. 4
UN 1002 .............................................. 4
Total .................................................. 16

2nd Year Fall
BL 2100 .............................................. 3
FW 3020 .............................................. 3
FW 3330 .............................................. 4
MA 2720 .............................................. 4
UN 2001 .............................................. 3
Total .................................................. 17

2nd Year Spring
FW 3110 .............................................. 3
FW 3540 .............................................. 4
UN 2002 .............................................. 3
Biological Elective ........................................... 3
Free Elective ............................................ 3
Total .................................................. 16

3rd Year Fall
BL 1040 .............................................. 4
FW 2010 .............................................. 4
FW 2050 .............................................. 3
FW 3360 .............................................. 3
UN 1001 .............................................. 3
Total .................................................. 17

3rd Year Spring
BL 2160 OR BL 2170 ........................................ 4
CH 1100 .............................................. 4
MA 1135 .............................................. 4
UN 1002 .............................................. 4
Total .................................................. 16

4th Year Fall
BL 1040 .............................................. 4
FW 2010 .............................................. 4
FW 2050 .............................................. 3
FW 3360 .............................................. 3
UN 1001 .............................................. 3
Total .................................................. 17

4th Year Spring
BL 2160 OR BL 2170 ........................................ 4
CH 1100 .............................................. 4
MA 1135 .............................................. 4
UN 1002 .............................................. 4
Total .................................................. 16

Total Credits Required: 128
Major Requirements—53-58 credits
BL courses required—40 credits
BL 1010 General Biology I ......................................... 4
BL 1020 General Biology II ........................................ 4

Applied Ecology & Environmental Sciences, BS
SECONDARY EDUCATION—GENERAL SCIENCE CONCENTRATION
School of Forestry and Wood Products
See School of Forestry and Wood Products and Department of Education for details and requirements.

Biological Sciences, BS
GENERAL CONCENTRATION
College of Sciences and Arts

Not sure which area of biology to pursue? Our general biology concentration has the greatest flexibility and most electives open to a biology major. It allows you to change into any other option without loss of any credits. Choose courses in molecular and biochemical techniques, physiology, organismal biology, ecology and evolutionary biology, field experience, laboratory techniques. If you have a broad interest in the biological sciences and a curiosity about how individual organisms function and interact with other living things and the environment, this option is for you. Your advisor will help you devise a course plan. You’ll have career opportunities in government and industry. Additional opportunities exist in secondary education, graduate school, or professional school.

Total Credits Required: 128
Major Requirements—53-58 credits
BL courses required—40 credits
BL 1010 General Biology I ......................................... 4
BL 1020 General Biology II ........................................ 4
### Biological Sciences, BS

**ECOLOGY CONCENTRATION**

*College of Sciences and Arts*

Our ecology concentration focuses on ecosystem processes and understanding the nature of organisms and their interactions. It uses all the sciences. Besides biology courses, you'll choose from specialty courses in aquatic and terrestrial systems, identification of organisms, statistics techniques, analytical chemistry, and research. You can broaden your perspective by solving engineering problems impacting the environment through environmental engineering courses; management and assessment through SFWP courses; environmental policy making through social sciences courses; geological and global approaches through geology and geological engineering courses. Your advisor will help you put together a course plan. Career opportunities exist in consulting, industry, government, environmental health, outdoor education, environmental law, as well as graduate school, professional school, and the Peace Corps.

**Total Credits Required: 128**

### Major Requirements—53–58 credits

See General Concentration

**Concentration Requirements—24–28 credits**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BL 1580 Introduction to Biological Sciences</td>
<td>4</td>
</tr>
<tr>
<td>BL 4470 Analysis of Biological Data</td>
<td>4</td>
</tr>
<tr>
<td>BL 2010 Anat &amp; Physiol I AND BL 2011 Anat &amp; Physiol I Lab OR</td>
<td>4</td>
</tr>
<tr>
<td>BL 4140 Plant Physiology</td>
<td>4</td>
</tr>
<tr>
<td>Choose 1 of the following:</td>
<td></td>
</tr>
<tr>
<td>BL 2160 Botany, 2170 Zoology, 3210 Gen. Microbiology, 4740 Introduction to Mycology, 4230 Virology</td>
<td>3–4</td>
</tr>
<tr>
<td>Biological sciences electives</td>
<td>6–8</td>
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</table>

**Free Electives—21–29 credits**

**General Education Requirements—28 credits**

**CORE**

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>UN 1001 Perspectives on Inquiry</td>
<td>3</td>
</tr>
<tr>
<td>UN 1002 World Cultures</td>
<td>4</td>
</tr>
<tr>
<td>UN 2001 Revisions</td>
<td>3</td>
</tr>
<tr>
<td>UN 2002 Institutions</td>
<td>3</td>
</tr>
<tr>
<td>Note: Two semesters of a single modern language (6 cr) in addition to UN 1003 World Cultures Activities (1 cr) can substitute for UN 1002.</td>
<td></td>
</tr>
</tbody>
</table>

**Distribution Courses**

Students must take two courses each from two different lists, one that has World Cultures as a prerequisite and one that has Institutions as a prerequisite. The fifth course can come from any list. See the General Education section for specific lists and allowed courses.

**Science/Math**—Satisfy by major requirements above.

**Co-Curricular Activities—3 units**

Currently only PE classes qualify; units are required for graduation, but are not included in the calculation of the GPA, or in the overall credits required for the degree.

### General Biological Sciences Model Schedule—example only; actual schedule may vary. Include 3 units of co-curricular activities.

#### 1st Year Fall

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
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<tbody>
<tr>
<td>BL 1010</td>
<td>4</td>
</tr>
<tr>
<td>BL 1880</td>
<td>4</td>
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<td>CH 1110</td>
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<td>CH 1111</td>
<td>1</td>
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<tr>
<td>UN 1001</td>
<td>3</td>
</tr>
<tr>
<td>CS 1121 OR BA 1200*</td>
<td>3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>16</strong></td>
</tr>
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</table>

#### 1st Year Spring

<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>BL 1120</td>
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<tr>
<td>MA 1135*</td>
<td>4</td>
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<td>UN 1002</td>
<td>4</td>
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<td><strong>Total</strong></td>
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#### 2nd Year Fall

<table>
<thead>
<tr>
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<th>Credits</th>
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<tbody>
<tr>
<td>BL 2100</td>
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<tr>
<td>CH 2410</td>
<td>3</td>
</tr>
<tr>
<td>CH 2411</td>
<td>3</td>
</tr>
<tr>
<td>CH 2421</td>
<td>2</td>
</tr>
<tr>
<td>PH 1100</td>
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<tr>
<td>UN 2002</td>
<td>3</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>17</strong></td>
</tr>
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</table>

#### 2nd Year Spring

<table>
<thead>
<tr>
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<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BL 2200</td>
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<tr>
<td>CH 2420</td>
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<tr>
<td>CH 2421</td>
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<td>PH 1100</td>
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<td>UN 2002</td>
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</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>15</strong></td>
</tr>
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</table>

#### 3rd Year Spring

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>General Ed Distribution</td>
<td>3</td>
</tr>
<tr>
<td>BL 3400</td>
<td>4</td>
</tr>
<tr>
<td>BL Concen Req/BL Elective</td>
<td>3–4</td>
</tr>
<tr>
<td>(3000-level or above)</td>
<td></td>
</tr>
<tr>
<td>PH 1110</td>
<td>3</td>
</tr>
<tr>
<td>PH 1200</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
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</tr>
</tbody>
</table>

#### 4th Year Fall

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Ed Distribution</td>
<td>3</td>
</tr>
<tr>
<td>BL Concen Req/BL Elective</td>
<td>3–4</td>
</tr>
<tr>
<td>(3000-level or above)</td>
<td></td>
</tr>
<tr>
<td>Free Elective</td>
<td>3</td>
</tr>
<tr>
<td>Free Elective</td>
<td>3</td>
</tr>
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<td>Free Elective</td>
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</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>15–17</strong></td>
</tr>
</tbody>
</table>

* Students placed on math ACT scores may elect the following schedule: (1) Fall MA 1033; Spring MA 1135; OR (2) Fall MA 1150; Spring MA 2150. The computer science requirement can be met in a later year.

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*Students placed on math ACT scores may elect the following schedule: (1) Fall MA 1033; Spring MA 1135; OR (2) Fall MA 1150; Spring MA 2150. The computer science requirement can be met in a later year.*
Ecology Model Schedule—example only; actual schedule may vary. Include 3 units of co-curricular activities.

1st Year Fall
BL 1010 ................................. 4
BL 1580 ................................. 1
CH 1110 ................................. 4
CH 1111 ................................. 1
UN 1001 ................................. 3
CS 1121 OR BA 1200* .... 3
Total ................................ 16

3rd Year Fall
BL 3400 ................................. 4
BL Concentration Req ... 3–4
PH 1110 ................................. 3
PH 1200 ................................. 1
Free Elective ..................... 3
Total ................................ 15

1st Year Spring
BL 1020 ................................. 4
CH 1120 ................................. 4
MA 1135* ................................. 4
UN 1002 ................................. 4
Total ................................ 16

3rd Year Spring
General Ed Distribution .... 3
BL Concentration Req ... 3–4
PH 1210 ................................. 3
Free Elective ..................... 3
Total ................................ 15–17

2nd Year Fall
General Ed Distribution .... 3
BL 2100 ................................. 3
CH 2410 ................................. 3
CH 2411 ................................. 1
UN 2001 ................................. 3
Free Elective ..................... 3–4
Total ................................ 16–17

4th Year Fall
General Ed Distribution .... 3
BL 4510 ................................. 2
BL Concentration Req ... 3–4
Free Elective ..................... 3–4
Total ................................ 15–17

2nd Year Spring
General Ed Distribution .... 3
BL 2200 ................................. 3
CH 2420 ................................. 3
CH 2421 ................................. 2
UN 2002 ................................. 3
PH 1100 ................................. 1
Total ................................ 15

* Students placed on math ACT scores may elect the following schedule: (1) Fall MA 1033; Spring MA 1135; OR (2) Fall MA 1150; Spring MA 2150. The computer science requirement can be met in a later year.

### Biological Sciences, BS

#### MICROBIOLOGY CONCENTRATION

**College of Sciences and Arts**

Have you ever had a cold, taken an antibiotic, eaten a sourkraut, drunk black tea, thrown away spoiled food from your refrigerator, washed your floor, or disinfected your bathroom? All of these things are related to microbiology. If you want to learn more about food production and spoilage, water quality and nutrient cycling, infectious diseases, or bioremediation of environmental contaminants, check out our this concentration. In addition to biology courses, you'll select courses in general microbiology, microbial physiology, organismal microbiology (such as mycology), immunology, biochemistry, and medical and environmental-related microbiology areas. Most of our microbiology courses have labs where you can learn about current research and testing procedures and equipment. Use your skills in these areas: microbial processes and applications, taxonomy and culture collections, and microbial-based product development. Put together a course plan with your advisor. Career opportunities exist in consulting, industry, government, environmental health, outdoor education, and environmental law. Additional opportunities exist in secondary education or graduate school.

Total Credits Required: 128

Major Requirements—53–58 credits

See General Concentration

#### Concentration Requirements—22–25 credits

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
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<tbody>
<tr>
<td>BL 1580</td>
<td>Introduction to Biological Sciences</td>
</tr>
<tr>
<td>BL 3210</td>
<td>General Microbiology</td>
</tr>
<tr>
<td>BL 4820</td>
<td>Biochem Techniques I OR BL 4830 Biochem Techniques II * OR BL 4840 Molecular Bio Technics</td>
</tr>
<tr>
<td>BL 3230</td>
<td>Medical Bacteriology OR BL 4130 Phylocgy OR BL4740 Introduction to Mycology</td>
</tr>
</tbody>
</table>

Choose 2 of the following:  
BL 4010 Biochem I, BL 4020 Biochem II, BL 4030 Molecular Bio

Choose 2 of the following:  
BL 3640 General Immunology, BL 4220 Appl Industrial Microbiology, BL 4230 Virology, BL 4470 Analysis of Biological Data, BL 4860 Toxicology, BL 5200 Microbial Physiology

Free Electives—17–25 credits

#### General Education Requirements—28 credits

See General Concentration

#### Co-Curricular Activities—3 units

See General Concentration

### Microbiology Model Schedule—example only; actual schedule may vary. Include 3 units of co-curricular activities.

1st Year Fall
BL 1010 ................................. 4
BL 1580 ................................. 1
CH 1110 ................................. 4
CH 1111 ................................. 1
UN 1001 ................................. 3
CS 1121 OR BA 1200* .... 3
Total ................................ 16

3rd Year Fall
BL 3400 ................................. 4
BL Concentration Req ... 3–4
PH 1110 ................................. 3
PH 1200 ................................. 1
Free Elective ..................... 3
Total ................................ 15

1st Year Spring
BL 1020 ................................. 4
CH 1120 ................................. 4
MA 1135* ................................. 4
UN 1002 ................................. 4
Total ................................ 16

3rd Year Spring
General Ed Distribution .... 3
BL Concentration Req ... 3–4
PH 1210 ................................. 3
Free Elective ..................... 3
Total ................................ 16

2nd Year Fall
General Ed Distribution .... 3
BL 2100 ................................. 3
CH 2410 ................................. 3
CH 2411 ................................. 2
UN 2002 ................................. 3
PH 1100 ................................. 1
Total ................................ 15

* Students placed on math ACT scores may elect the following schedule: (1) Fall MA 1033; Spring MA 1135; OR (2) Fall MA 1150; Spring MA 2150. The computer science requirement can be met in a later year.

** See your academic advisor.

### Biological Sciences, BS

#### MOLECULAR/BIOCHEMISTRY CONCENTRATION

**College of Sciences and Arts**

Molecular biology and biochemistry are center stage in the field of biology and will be for the foreseeable future. Well-trained lab technicians and research personnel are in demand. Your first step is earning a BS degree in Biological Sciences with the molecular biology and biochemistry concentration. Start with your biology core courses and add courses in math, qualitative and organic chemistry, microbiology, genetics, and biochemistry. Also take specific lab courses dealing with the isolation, purification, and assay of cellular enzymes involving aspects of protein structure, function, and folding kinetics; techniques for membrane purification and analysis of cellular membrane systems; gene cloning, sequencing, and identification techniques; bacterial and plant cell transformation procedures; and development of expression vectors for plant, animal, and bacterial systems. Your advisor will help you put together a course plan. Career opportunities exist as a research molecular biologist, a research biochemist, or a laboratory technician as well as secondary education and graduate school.
**Total Credits Required: 128**

**Major Requirements—53–58 credits**

See General Concentration

**Concentration Requirements—25 credits**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BL 1580 Introduction to Biological Sciences</td>
<td>1</td>
</tr>
<tr>
<td>BL 3210 General Microbiology</td>
<td>4</td>
</tr>
<tr>
<td>BL 4010 Biochemistry I</td>
<td>3</td>
</tr>
<tr>
<td>BL 4020 Biochemistry II</td>
<td>3</td>
</tr>
<tr>
<td>BL 4030 Molecular Biology</td>
<td>3</td>
</tr>
<tr>
<td>BL 4820 Biochemical Laboratory Techniques</td>
<td>3</td>
</tr>
<tr>
<td>BL 4830 Biochemical Techniques*</td>
<td>3</td>
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<tr>
<td>BL 4840 Molecular Biology Techniques</td>
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</tr>
<tr>
<td>CH 3500 Phys Chem for Environ and Life Sciences</td>
<td>2</td>
</tr>
</tbody>
</table>

Free Electives—17–22 credits

**General Education Requirements—28 credits**

See General Concentration

**Co-Curricular Activities—3 units**

See General Concentration

**Molecular/Biochemistry Model Schedule—example only; actual schedule may vary. Include 3 units of co-curricular activities.**

<table>
<thead>
<tr>
<th>1st Year Fall</th>
<th>2nd Year Fall</th>
<th>3rd Year Fall</th>
<th>4th Year Fall</th>
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<tbody>
<tr>
<td>BL 1010</td>
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<td>BL 1580</td>
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<td>CH 1110</td>
<td>MA 1150</td>
<td>BL 4020</td>
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<td>CH 1111</td>
<td>PH 1100</td>
<td>BL 4820</td>
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<table>
<thead>
<tr>
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<th>4th Year Spring</th>
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<td>PH 1110 OR PH 1210</td>
<td>UN 1002</td>
<td>BL 4820</td>
<td>BL 4820</td>
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<tr>
<td>UN 2001</td>
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<td>CS 1121 OR BA 1200</td>
<td>UN 1001</td>
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<th>4th Year Spring</th>
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<tbody>
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<td>BL 2200</td>
<td>BL 1010</td>
<td>BL 1010</td>
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<tr>
<td>CH 2420</td>
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<td>PH 1220 OR PH 2200</td>
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<tr>
<td>Total</td>
<td>18</td>
<td>17–18</td>
<td>17–18</td>
</tr>
</tbody>
</table>

* See your academic advisor.

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**Biological Sciences, BS**

**Plant Sciences Concentration**

*College of Sciences and Arts*

Choose your own path. Like math? Go into systems ecology, genetics, or biophysics. Prefer the outdoors? Become an ecologist, taxonomist, forester or plant explorer. Interested in plant structures? Cryptology, anatomy, or morphology may be right for you. Love chemistry? Become a plant physiologist, plant biochemist, molecular biologist, chemotaxonomist, or biochemical ecologist. Concerned about the world food supply? Go into plant pathology or plant breeding. Besides biology courses, you'll take courses in botany, plant physiology, molecular and biochemical techniques, ecology and evolutionary biology, and field studies. Additional specialty courses include algae, biological ultrastructure (using the electron microscope in our world-class facility), and laboratory teaching experience. Use your skills in these areas: improving food supplies, medicines, fibers, and building materials; managing parks, forests, range lands, and wilderness areas, and environmental pollution concerns. Your advisor will help you put together a course plan. Career opportunities exist in horticulture, public service, industrial research, and government research as well as secondary education, graduate school, and the Peace Corps.

**Total Credits Required: 128**

**Major Requirements—53–58 credits**

See General Concentration

**Concentration Requirements—21–24 credits**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
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<tbody>
<tr>
<td>BL 1580 Introduction to Biological Sciences</td>
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</tr>
<tr>
<td>BL 2160 Botany</td>
<td>4</td>
</tr>
<tr>
<td>BL 4010 Biochemistry I</td>
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<tr>
<td>BL 4140 Plant Physiology</td>
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<tr>
<td>Choose 3 of the following:</td>
<td>9–12</td>
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<tr>
<td>BL 3210 Gen Microbiology, BL 3190 Evolution, BL 4020 Biochem II, BL 4130 Phycolgy, BL 4740 Intro to Mycology, BL 4810 Plant Taxonomy, BL 5680 Bryology</td>
<td></td>
</tr>
</tbody>
</table>

Free Electives—18–26 credits

**General Education Requirements—28 credits**

See General Concentration

**Co-Curricular Activities—3 units**

See General Concentration

**Plant Sciences Model Schedule—example only; actual schedule may vary. Include 3 units of co-curricular activities.**

<table>
<thead>
<tr>
<th>1st Year Fall</th>
<th>2nd Year Fall</th>
<th>3rd Year Fall</th>
<th>4th Year Fall</th>
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<tbody>
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<td>BL 1010</td>
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<td>BL 1010</td>
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* Students placed on math ACT scores may elect the following schedule: (1) Fall MA 1033; Spring MA 1135; OR (2) Fall MA 1150; Spring MA 2150. The computer science requirement can be met in a later year.
**Biological Sciences, BS**

**PRE-PROFESSIONAL CONCENTRATION**

*College of Sciences and Arts*

This concentration is for students who want to enter a health professions career. A BS degree in biological sciences from MTU automatically meets the entrance requirements for all medical, dental, veterinary, and pharmacy schools in Michigan and for most schools in other states. In fact, all of the entrance requirements for all health professions’ schools nationwide (except for some physical therapy and physician assistant programs) can be met through this concentration. Since your degree is in biological sciences, you’ll also be fully qualified to enter graduate school in biology. Besides biology courses, you may take other electives such as biomedical ethics, sociology, psychology, small business management, neuromuscular physiology, cardiopulmonary physiology, hematology, parasitology, human nutrition, and endocrinology. Work closely with your advisor, tailoring your studies to the specific requirements of your chosen pre-health field.

**Total Credits Required: 128**

**Major Requirements—53–58 credits**

See General Concentration

<table>
<thead>
<tr>
<th>Concentration Requirements—29 credits</th>
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<tbody>
<tr>
<td>BL 1590 Introduction to PreMedicine</td>
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<tr>
<td>BL 2010 Anatomy &amp; Physiology I</td>
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<td>BL 2011 Anatomy &amp; Physiology I Lab</td>
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<tr>
<td>BL 2020 Anatomy &amp; Physiology II</td>
</tr>
<tr>
<td>BL 2021 Anatomy &amp; Physiology II Lab</td>
</tr>
<tr>
<td>BL 3210 General Microbiology</td>
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<tr>
<td>BL 4010 Biochemistry I</td>
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<tr>
<td>BL 4020 Biochemistry II</td>
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<td>BL 4470 Analysis of Biological Data</td>
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<td>Biological sciences electives (3000 level or above)</td>
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<td>Free Electives—13–18 credits</td>
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**General Education Requirements—28 credits**

See General Concentration

<table>
<thead>
<tr>
<th>Co-Curricular Activities—3 units</th>
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</table>

**Pre-Professional Model Schedule—example only; actual schedule may vary.**

Include 3 units of co-curricular activities.

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<td>PH 1100</td>
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<tr>
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<table>
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<tbody>
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<tr>
<td>PH 1200</td>
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<tr>
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<tr>
<td>BL 4010</td>
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<td>BL Elective (3000 level or above)</td>
</tr>
<tr>
<td>Free Elective</td>
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<tr>
<td>BL 4470</td>
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<td>BL 4510</td>
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<thead>
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<td>BL 2100</td>
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<td>BL 2170</td>
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<tr>
<td>CH 2410</td>
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<tr>
<td>CH 2411</td>
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<tr>
<td>PSY 2000</td>
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<td>UN 2001</td>
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</table>

* Students placed on math ACT scores may elect the following schedule: (1) Fall MA 1033; Spring MA 1133; OR (2) Fall MA 1150; Spring MA 2150. The computer science requirement can be met in a later year.

---

**Biological Sciences, BS**

**SECONDARY EDUCATION—BIOLOGY CONCENTRATION**

*College of Sciences and Arts*

If your goal is to teach at the high school level, you can earn your BS degree, take additional education courses, do your student teaching, and qualify to take the Michigan Test for Teacher Certification. Contact the Department of Education office (906-487-2460) after your arrival at Michigan Tech.

**Total Credits Required: 133–141**

**Major Requirements—53–58 credits**

See General Concentration

<table>
<thead>
<tr>
<th>Concentration Requirements—52–55 credits</th>
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<tbody>
<tr>
<td>BL 1590 Introduction to Biological Sciences</td>
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<tr>
<td>BL 2160 Botany</td>
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<td>BL 2170 Zoology</td>
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<tr>
<td>BL 4470 Analysis of Biological Data</td>
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Choose 1 of the following: 4

(BL 2010 Anatomy & Physiology I AND BL 2011 Anatomy & Physiology I Lab)

OR (BL 2110 Anatomy & Physiology I AND BL 2120 Anatomy & Physiology II)

**Free Electives—0 credits**

**General Education Requirements—28 credits**

See General Concentration

**Co-Curricular Activities—3 units**

See General Concentration

**Biology Secondary Ed Model Schedule—example only; actual schedule may vary.**

Include 3 units of co-curricular activities.

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<td>CH 1111</td>
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<tr>
<td>CS 1121 OR 1200</td>
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<td>UN 1001</td>
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<tr>
<td>PH 1100</td>
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<tr>
<td>UN 2002</td>
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<tr>
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<tbody>
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<tr>
<td>PH 1110</td>
</tr>
<tr>
<td>PH 1200</td>
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<td>Free Elective</td>
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<td>BL 4010</td>
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<tr>
<td>BL 4470</td>
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<td>BL 2170</td>
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**Baccalaureate Degree Requirements**
Biomedical Engineering, BS

College of Engineering

A biomedical engineer uses the tools of engineering design and analysis to solve problems related to human biology and medicine. Examples of biomedical engineering include design and manufacture of prosthetic devices, sports safety equipment, medical and surgical instruments, and the safety design of automobiles. Biomedical engineering education involves extensive course work in engineering as well as course work in human biology. Biomedical engineering can also be used as preparation to enter medical school. For more information, contact the director of the Center for Biomedical Engineering at Michigan Tech.

Total Credits Required: 131

Major Requirements—58 credits

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<td>EE 3010</td>
<td>Circuits and Instrumentation</td>
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<tr>
<td>ENG 1110</td>
<td>Fundamentals of Engineering I</td>
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<td>ENG 1102</td>
<td>Fundamentals of Engineering II</td>
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<tr>
<td>MA 1150</td>
<td>Calculus I OR MA 1160 Calculus with Technology I</td>
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<td>Calculus II OR MA 2160 Calculus with Technology II</td>
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<td>Engineering Statistics</td>
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<td>MEEM 2120</td>
<td>Statics Strength of Materials OR MEEM 2110 Statics AND 2150 Mechanics of Mat</td>
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<td>MEEM 2200</td>
<td>Thermodynamics</td>
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<td>Dynamics</td>
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<td>Univ Physics II-Elec and Magnetism</td>
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Concentration Requirements—42 credits

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<td>BE 3500</td>
<td>Biomedical Materials</td>
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<tr>
<td>BE 3600</td>
<td>Biomedical Instrumentation</td>
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<td>BE 3750</td>
<td>Human Biomechanics</td>
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<td>BE 4920</td>
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<tr>
<td>BL 2111</td>
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<td>BL 2020</td>
<td>Anatomy &amp; Physiology II Lab</td>
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<td>CH 1111</td>
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Free Elective—3 credits

General Education Requirements—28 credits

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Total 15–19

* Students placed on math ACT scores may elect the following schedule: (1) Fall MA 1150; Spring MA 1135; OR (2) Fall MA 1150; Spring MA 2150. The computer science requirement can be met in a later year.

Biomedical Model Schedule—example only; actual schedule may vary. Include 3 units of co-curricular activities.

1st Year Fall

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<td>MA 1100</td>
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| Total 16

1st Year Spring

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<td>MA 2160</td>
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| Total 17–18

2nd Year Fall

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<td>UN 2001 OR 2002</td>
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| Total 15–16

2nd Year Spring

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<td>UN 2001 OR 2002</td>
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</table>
| Total 16

Biomedical Engineering, BS

ENGINEERING ENTERPRISE CONCENTRATION

College of Engineering

Biomedical Engg Enterprise Model Schedule—example only; actual schedule may vary. Include 3 units of co-curricular activities.

Total Credits Required: 131

Major Requirements—52 credits

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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<tbody>
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</tr>
<tr>
<td>EE 3010</td>
<td>.</td>
<td>3</td>
</tr>
</tbody>
</table>

Total 17

College of Engineering
ENG 1101 Fundamentals of Engineering I ........................................ 3
ENG 1102 Fundamentals of Engineering II ...................................... 3
MA 1150 Calculus I OR MA 1160 Calculus with Technology .......... 4
MA 2150 Calculus II OR MA 2160 Calculus with Technology .......... 4
MA 2320 Elementary Linear Algebra ........................................... 2
MA 3520 3rd Edition Equations OR
MA 3530 Intro to Differential Equations ................................. 2-3
MA 3710 Engineering Statics ...................................................... 3
MEEM 2120 Statics Strength of Materials OR
MEEM 2110 Statics AND 2150 Mechanics of Mat .......... 4-6
MEEM 2200 Thermodynamics .................................................. 3
MEEM 2700 Dynamics ............................................................. 3
MEEM 3210 Fluid Mechanics ..................................................... 3
MY 2100 Intro to Materials Science and Engineering .............. 3
PH 1100 Introductory Physics Lab I .......................................... 1
PH 1200 Introductory Physics Lab II .......................................... 1
PH 2100 Univ Physics I-Mechanics ........................................... 3
PH 2200 Univ Physics II-Electricity and Magnetism ............... 3

Concentration Requirements—51 credits
BE 3500 Biomedical Materials .................................................. 3
BE 3600 Biomedical Instrumentation ......................................... 3
BE 3700 Human Biomechanics ................................................ 3
BE 4520 Professional Development .......................................... 1
BE 4520 Professional Development .......................................... 1
BL 2010 Anatomy & Physiology I ............................................ 3
BL 2011 Anatomy & Physiology I Lab ..................................... 1
BL 2020 Anatomy & Physiology II .......................................... 3
BL 2021 Anatomy & Physiology II Lab ................................ 1
CH 1111 University Chemistry Lab I ....................................... 1
CH 1120 University Chemistry II ............................................ 4
EC 3400 Economic Decision Analysis ........................................ 3
ENG 2950 Engineering Enterprise Orientation ............................. 1
ENG 2950 Engineering Enterprise Project Work I ..................... 1
ENG 3950 Engineering Enterprise Project Work II ..................... 1
ENG 3950 Engineering Enterprise Project Work III .................... 1
ENG 3950 Engineering Enterprise Project Work IV ................... 1
ENG 4950 Engineering Enterprise Project Work V .................... 2
MEEM 3230 Heat Transfer ....................................................... 3
Approved ENG elective modules .............................................. 5

ENG 3401 Econ Decision Analy I, 3402 Econ Decision Analy II, 3403 Econ
Decision Analy III, 3954 Enterprise Market Principles, 3955 Concept Design
Protovol, 3956 Industrial Health and Safety, 3961 Engg Ent Strat
Leadership, 3964 Prog Management, 3965 Material Flow Ind Society, 3965
Design for Manufacturing, 3970 Enterprise Special Topics, 4951 Budgeting
Entrepreneur Engg, 4952 Complex Comm Practices, 4953 Writing Engg Societal
Context, 4954 Global Competition, 4970 Enterprise Spec Topics

Free Electives—0 credits

General Education Requirements—28 credits
CORE ............................................................... 13
UN 1001 Perspectives on Inquiry ............................................. 3
UN 1002 World Cultures ....................................................... 4
UN 2001 Revisions ............................................................ 3
UN 2002 Institutions ............................................................ 3

Note: Two semesters of a single modern language (6 cr) in addition to UN 1003 World
Cultures Activities (1 cr) can substitute for UN 1002.

DISTRIBUTION COURSES ................................................ 15

Students must take two courses each from two different lists, one that has
World Cultures as a prerequisite and one that has Institutions as a
prerequisite. The fifth course can come from any list. See the General
Education section for specific lists and allowed courses. This program requires
the following in place of the fifth course:
ENG 2960 Engineering Enterprise Project Work
ENG 2962 Communication Contexts .................................... 1
ENG 3962 Communication Strategies ................................... 1

SCIENCE/MATH—Satisfied by major requirements above.

Co-Curricular Activities—3 units

Currently only PE classes qualify; units are required for graduation, but are not
included in the calculation of the GPA, or in the overall credits required for the
degree.

Biomedical Engg Enterprise Model Schedule—example only; actual schedule
may vary. Include 3 units of co-curricular activities.

1st Year Fall
CH 1111 ............................................ 4
ENG 4950 ............................................ 2
ENG Electives ............................................ 1
MA 1160 ............................................ 4
PH 1100 ............................................ 1
UN 1001 ............................................ 3
Total .................................................. 16

1st Year Spring
CH 1120 ............................................ 4
ENG Electives ............................................ 1
ENG Electives ............................................ 1
MA 2160 ............................................ 4
PH 2100 ............................................ 3
UN 1002 ............................................ 4
Total .................................................. 18

2nd Year Fall
BL 2011 ............................................ 1
ENG Electives ............................................ 2
MA 3520 ............................................ 2
MEEM 2120 ............................................ 4
PH 1200 ............................................ 1
UN 2001 ............................................ 3
Total .................................................. 17

2nd Year Spring
BL 2021 ............................................ 1
ENG Electives ............................................ 1
MA 3960 ............................................ 1
MA 2160 ............................................ 1
MY 2100 ............................................ 3
PH 2200 ............................................ 3
UN 2002 ............................................ 3
Total .................................................. 16

Total .................................................. 17

Business Administration, BS
ACCOUNTING CONCENTRATION

School of Business and Economics

Accounting is the language of business. Accounting students learn to collect,
summarize, and report financial information and evaluate the integrity of financial
information systems. Accountants' roles are changing from being passive
processors and providers of financial information to active and trusted
participants in the business decision-making processes. Accountants must be
skilled and knowledgeable in issues related to an aging population, information
technology, and the global economy. The accounting profession is establishing
new credentials (in addition to the traditional CPA and CMA certifications) that
recognize and reward accountants who develop expertise in these emerging
issues. Graduates are partners in international, regional, and local CPA firms, chief
financial officers of major corporations, and owners of their own businesses.
Graduates increasingly have assumed roles as information system experts,
producers of assurance services, and members of corporate management teams.

Total Credits Required: 128

Major Requirements—72–75 credits
BA 1200 ISIT Fundamentals .................................................. 3
BA 1700 Business Orientation ................................................ 1
BA 2100 Business Statistics .................................................. 3
BA 2110 Quantitative Problem Solving .................................. 3
BA 2300 Accounting Principles I ....................................... 3
BA 2310 Accounting Principles II ..................................... 3
BA 2500 Business Law I ...................................................... 3
BA 2700 Business Problem Solving ...................................... 4
### Accounting Electives
- **BA 4310 Foundations of Taxation**: 3 credits
- **BA 3320 Cost Accounting**: 3 credits
- **BA 3310 Accounting Theory/Practice II**: 3 credits

### Technology Core
- **EC 3100 International Economics**: 3 credits
- **EC 3300 Industrial Organization**: 3 credits

### Mathematics: Choose one group

**Group 1**: (MA 1032 Data, Functions, & Graphs Plus OR 1033 Data, Functions, & Graphs) AND (MAT 1135 Calculus for Life Sciences OR 1150 Calculus I OR 1151 Calculus I Plus OR 1160 Calculus with Technology I OR 1161 Calculus Plus w/ Technology I)

**Group 2**: (MAT 1115 Technical Mathematics I AND MAT 1125 Technical Mathematics II)

### Lab Science (BL, CH, FW, GE, OR PH)
- 4 credits

### Total for ACCALAUREATE DEGREE REQUIREMENTS: 12–15 credits

### MA Requirement
- 4–5 credits

### General Ed Distribution* (Choose from College of Engg, Sch of Technology, Sch of Forestry and Wood Products, or College of Sciences and Arts)
- 3 credits

### 1st Year Spring
- **BA 1200**: 3 credits

### 1st Year Fall
- **BA 3300 Accounting Theory/Practice I**: 3 credits
- **BA 3310 Accounting Theory/Practice II**: 3 credits
- **BA 3320 Cost Accounting**: 3 credits
- **BA 4300 Attestation and Assurance**: 3 credits
- **BA 4310 Foundations of Taxation**: 3 credits
- **Accounting Electives (choose one track)**: 6 credits
- **CPA Track**: Consult an accounting faculty member to determine appropriate elective courses.
- **Managerial Track**: BA 4390 Contemporary Cost Management AND BA 4350 Advanced Tax Topics OR 4360 Accounting Systems OR 4370 Advanced & Govt. Accounting OR 4380 Accounting Theory

### Free Electives—4–7 credits

### Concentration Requirements—21 credits
- **BA 3300 Accounting Theory/Practice I**: 3 credits
- **BA 3310 Accounting Theory/Practice II**: 3 credits
- **BA 3320 Cost Accounting**: 3 credits
- **BA 4300 Attestation and Assurance**: 3 credits
- **BA 4310 Foundations of Taxation**: 3 credits
- **Accounting Electives (choose one track)**: 6 credits
- **CPA Track**: Consult an accounting faculty member to determine appropriate elective courses.
- **Managerial Track**: BA 4390 Contemporary Cost Management AND BA 4350 Advanced Tax Topics OR 4360 Accounting Systems OR 4370 Advanced & Govt. Accounting OR 4380 Accounting Theory

### Total Credits Required: 128

### Business Administration, BS

#### BUSINESS FINANCE/FINANCIAL ECONOMICS CONCENTRATION

**School of Business and Economics**

This concentration focuses on financial decision making in corporations, financial institutions, and investment-related organizations. Students learn decision-making techniques useful to analyze investments, to value securities such as stocks and bonds, and to understand how financial markets function. Graduates find employment in corporate finance departments, banks, investment companies, and other financial institutions. Career trends include increasing emphasis upon financial modeling, international financial transactions, and foreign exchange markets. Further study includes short courses, professional designations (CFA, CPA), and graduate programs.

### Total Credits Required: 128

### See Accounting Concentration

#### Concentration Requirements—18 credits
- **BA 4400 Investment Analysis**: 3 credits
- **BA 4410 Advanced Financial Management**: 3 credits
- **EC 4400 Banking & Financial Institutions**: 3 credits

Choose 9 credits from List A OR 6 credits from List A and 3 credits from List B

<table>
<thead>
<tr>
<th>List A</th>
<th>List B</th>
</tr>
</thead>
<tbody>
<tr>
<td>BA 4460 Derivatives and Financial Engg</td>
<td>EC 3010 Microeconomics</td>
</tr>
<tr>
<td>BA 4470 Applied Portfolio Management</td>
<td>BA 3300 Accounting Theory/Practice I</td>
</tr>
<tr>
<td>BA 4480 Global Finance</td>
<td>EC 4320 Econometrics</td>
</tr>
<tr>
<td>BA 4490 Personal Financial Planning</td>
<td>EC 4300 Microeconomic Theory</td>
</tr>
</tbody>
</table>

### Free Electives—7–10 credits

### See Accounting Concentration

#### Concentration Requirements—28 credits

### See Accounting Concentration

#### Co-Curricular Activities—3 units

Currently only PE classes qualify; units are required for graduation, but are not included in the calculation of the GPA. CR in the overall credits required for the degree.

#### Accounting Model Schedule—example only; actual schedule may vary. Include 3 units of co-curricular activities.

<table>
<thead>
<tr>
<th>1st Year Fall</th>
<th>2nd Year Fall</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>BA 1200</strong></td>
<td><strong>General Ed Distribution</strong></td>
</tr>
<tr>
<td><strong>BA 1700 OR Modern Lang</strong>*</td>
<td><strong>BA 2100</strong></td>
</tr>
<tr>
<td><strong>Lab Science</strong></td>
<td><strong>BA 2300</strong></td>
</tr>
<tr>
<td><strong>MA Requirement</strong></td>
<td><strong>BA 2700</strong></td>
</tr>
<tr>
<td><strong>UN 1001</strong></td>
<td><strong>UN 2001</strong></td>
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<td><strong>Total</strong></td>
<td><strong>Total</strong></td>
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<td>14–18</td>
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</table>

<table>
<thead>
<tr>
<th>1st Year Spring</th>
<th>2nd Year Spring</th>
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<tbody>
<tr>
<td><strong>General Ed Distribution</strong></td>
<td><strong>General Ed Distribution</strong></td>
</tr>
<tr>
<td><strong>General Ed Dist</strong> OR <strong>BA 1700</strong></td>
<td><strong>BA 2110</strong></td>
</tr>
<tr>
<td><strong>MA Requirement</strong></td>
<td><strong>Technology Core</strong></td>
</tr>
<tr>
<td><em><em>Modern Lang</em> AND UN 1003</em> OR**</td>
<td><strong>BA 2310</strong></td>
</tr>
<tr>
<td><strong>UN 1002</strong></td>
<td><strong>BA 2500</strong></td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>Total</strong></td>
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<tr>
<td>12–15</td>
<td>18</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>3rd Year Fall</th>
<th>4th Year Fall</th>
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</thead>
<tbody>
<tr>
<td><strong>BA 3200</strong></td>
<td><strong>General Ed Dist</strong> OR <strong>Free Elective</strong></td>
</tr>
<tr>
<td><strong>BA 3300</strong></td>
<td><strong>BA 3410</strong></td>
</tr>
<tr>
<td><strong>BA 3320</strong></td>
<td><strong>BA 4600</strong></td>
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<tr>
<td><strong>BA 3400</strong></td>
<td><strong>BA 4710</strong></td>
</tr>
<tr>
<td><strong>BA 3700</strong></td>
<td><strong>Concentration Elective</strong></td>
</tr>
<tr>
<td><strong>Technology Core</strong></td>
<td><strong>Free Elective</strong></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>Total</strong></td>
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<td>18</td>
<td>17</td>
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</table>

<table>
<thead>
<tr>
<th>3rd Year Spring</th>
<th>4th Year Spring</th>
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</thead>
<tbody>
<tr>
<td><strong>BA 3310</strong></td>
<td><strong>General Ed Dist</strong> OR <strong>Free Elective</strong></td>
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<tr>
<td><strong>BA 3600</strong></td>
<td><strong>BA 4300</strong></td>
</tr>
<tr>
<td><strong>BA 3610</strong></td>
<td><strong>BA 4700</strong></td>
</tr>
<tr>
<td><strong>BA 3800</strong></td>
<td><strong>Concentration Elective</strong></td>
</tr>
<tr>
<td><strong>EC 3100</strong></td>
<td><strong>Total</strong></td>
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<tr>
<td><strong>EC 3300</strong></td>
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<td><strong>Total</strong></td>
</tr>
<tr>
<td>18</td>
<td>18</td>
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</tbody>
</table>

* The SBE recommends that students take at least two semesters of language. Two semesters of a single modern language (6 credits) in addition to UN 1003 World Cultures Activities (1 credit) can substitute for UN 1002. Further language study can be counted as distribution courses.

** To satisfy the technology core requirement, students may select 6 credits for ENG 2950, ENG 3950 OR 3960, and ENG 4950 OR 4960; or they may develop technology clusters with their advisors that correspond with their career interests.

### Business Finance Model Schedule—example only; actual schedule may vary. Include 3 units of co-curricular activities.

<table>
<thead>
<tr>
<th>1st Year Fall</th>
<th>1st Year Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>UN 1001</strong></td>
<td><strong>12-15</strong></td>
</tr>
<tr>
<td><strong>BA 1200</strong></td>
<td><strong>BA 1700 OR Modern Lang</strong>*</td>
</tr>
<tr>
<td><strong>BA 2100</strong></td>
<td><strong>MA Requirement</strong></td>
</tr>
<tr>
<td><strong>BA 2310</strong></td>
<td><em><em>Modern Lang</em> AND UN 1003</em> OR**</td>
</tr>
<tr>
<td><strong>BA 2500</strong></td>
<td><strong>UN 1002</strong></td>
</tr>
<tr>
<td><strong>EC 2000</strong></td>
<td><strong>Total</strong></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>14-18</strong></td>
</tr>
</tbody>
</table>

12 BACALAUREATE DEGREE REQUIREMENTS
Business Administration, BS

Industrial Marketing and Management Concentration

School of Business and Economics

Students selecting this concentration learn techniques for effectively anticipating the demand for goods and services and their coordination, development, promotion, and distribution, as well as production methods, technology management, human behavior, planning, and decision making, and quality management techniques. Graduates work in industrial and consumer sales, marketing research, public relations, advertising, purchasing, distribution, and logistics activities. Industrial Management graduates are employed in operations and human resource management and quality management in manufacturing and service industries. Industrial management career trends include the integration of operations and information systems management to more effectively manage businesses. In marketing, an important emerging field is Internet marketing. The future is especially bright in industrial sales, supply chain management, and logistics. MTU is one of the few universities that allows students to specialize in industrial marketing. Opportunities exist for professional certification such as certified production and inventory management, certified quality auditor, certified quality engineer, and certified quality manager.

Total Credits Required: 128

Major Requirements—72–75 credits
See Accounting Concentration

Concentration Requirements—18 credits
BA 4610 Project Management ........................................ 3
BA 4800 Business Research ........................................ 3
Choose 12 credits from Lists A & B with at least 3 credits from each list.
List B: BA 3780 Entrepreneurship, 4750 Managing Change, 4760 Strategic Leadership, 4770 Human Resource Management, 4780, International Business
Total .............................. 18

Free Electives—7–10 credits

General Education Requirements—28 credits
See Accounting Concentration

Co-Curricular Activities—3 units
See Accounting Concentration

IM & M Model Schedule—example only; actual schedule may vary. Include 3 units of co-curricular activities.

1st Year Fall
BA 1200 ........................................ 3
BA 1700 OR Modern Lang* ........................................ 1–3
UN 1001 ........................................ 3
Lab Science ........................................ 3–4
MA Requirement ........................................ 4–5
Total ........................................ 14–18

1st Year Spring
General Ed Distribution* ........................................ 3
General Ed Dist* OR Free Elective ............................ 3
Concentration Elective ........................................ 3
Concentration Elective ........................................ 3
Total ........................................ 17

2nd Year Fall
BA 2110 ........................................ 3
BA 2310 ........................................ 3
BA 2500 ........................................ 3
EC 2000 ........................................ 3
Technology Core* ........................................ 3
Total ........................................ 18

2nd Year Spring
General Ed Distribution* ........................................ 3
General Ed Dist* OR Free Elective ............................ 3
Lab Science ........................................ 3–4
Modern Lang* AND UN 1003* OR
UN 1002 ........................................ 4
Total ........................................ 12–15

3rd Year Fall
BA 3200 ........................................ 3
BA 3400 ........................................ 3
BA 3600 ........................................ 3
BA 3700 ........................................ 3
EC 3100 ........................................ 3
Technology Core* ........................................ 3
Total ........................................ 18

3rd Year Spring
General Ed Distribution* ........................................ 3
General Ed Dist* OR Free Elective ............................ 3
Concentration Elective ........................................ 3
Concentration Elective ........................................ 3
Total ........................................ 13

4th Year Fall
BA 4710 ........................................ 3
BA 4410 ........................................ 3
BA 4600 ........................................ 3
BA 4700 ........................................ 3
Concentration Elective ........................................ 3
Concentration Elective ........................................ 3
Free Elective ........................................ 4
Total ........................................ 18

4th Year Spring
General Ed Distribution* ........................................ 3
General Ed Dist* OR Free Elective ............................ 3
Concentration Elective ........................................ 3
Concentration Elective ........................................ 3
Free Elective ........................................ 4
Total ........................................ 16

* The SBE recommends that students take at least two semesters of language. Two semesters of a single modern language (6 credits) in addition to UN 1003 World Cultures Activities (1 credit) can substitute for UN 1002. Further language study can be counted as distribution courses.
** To satisfy the technology core requirement, students may select 6 credits for ENG 2950, ENG 3950 OR 3960, and ENG 4950 OR 4960; or they may develop technology clusters with their advisors that correspond with their career interests.

Business Administration, BS

Management Information Systems Concentration

School of Business and Economics

The MIS program is the most rapidly growing SBE program. Students selecting this concentration acquire skills and knowledge needed to analyze, design, implement, and deploy information technology (IT) within technology-rich organizations. The demand for MIS graduates far exceeds supply. Graduates have a wide range of employment opportunities in technology-rich businesses. Future career opportunities are limitless for graduates who have the skills and knowledge needed to develop creative and strategic information technology innovations in response to the challenges of global competition.

Total Credits Required: 128

Major Requirements—72–75 credits
See Accounting Concentration

Concentration Requirements—21 credits
BA 2200 Business Programming Concepts .................. 3
BA 3210 Business Database Management .................. 3
BA 3220 Systems Analysis and Design .................. 3

Baccalaureate Degree Requirements 13
Chemical Engineering, BS
College of Engineering

Chemical engineering combines chemistry and engineering to produce chemicals and discover new ways to use them. Plastics, artificial fibers, paints, fertilizers, pesticides, and household cleaning products are just a few items created by chemical engineers. They also take on environmental challenges, such as desalination of seawater and refining petroleum more efficiently. In medicine, chemical engineers develop ways to mass-produce lifesaving drugs and vaccines. Courses include lab work in modern, fully equipped process control, polymer, and unit operations laboratories. Our $1.5 million Process Simulation and Control Center, the only one of its kind at a university, includes pilot-plant-scale equipment to perform sixteen individual chemical operations. Our distributed control system, mainframe computer, and workstations let you implement sophisticated control schemes, perform on-line analysis, and simulate chemical processes. Graduates have been recruited by many employers, including Dow Chemical Company, Procter & Gamble, 3M, DuPont, and Kimberly-Clark.

Total Credits Required: 131
Major Requirements—100 credits
CH 1110 University Chemistry I .................................................. 4
CH 1111 University Chemistry Lab I .............................................. 1
CH 1120 University Chemistry II .................................................. 4
CH 2400 Principles of Organic Chemistry ..................................... 4
CH 2411 Organic Chemistry Lab I .................................................. 1
CH 3510 Physical Chemistry I ..................................................... 3
CH 3530 Physical Chemistry Lab I .................................................. 2
QM 2110 Fundamentals of Chem Engg 1 ......................................... 3
QM 2120 Fundamentals of Chem Engg 2 ......................................... 3
QM 3110 Transport/Unit Operations 1 ............................................. 3
QM 3115 Measurement & Analysis of Data ..................................... 1
QM 3120 Transport/Unit Operations 2 ............................................. 3
QM 3210 Classical Thermodynamics .............................................. 3
QM 3220 Chem Engg Thermodynamics ......................................... 3
QM 3310 Process Control ............................................................ 1
QM 3311 Instrumentation Lab ....................................................... 1
QM 3510 Chemical Reaction Engineering ...................................... 3
QM 4110 Unit Operations Laboratory .............................................. 3
QM 4120 Chemical Plant Operations Lab ....................................... 3
QM 4310 Chemical Process Safety/Env .......................................... 3
QM 4850 QM Process Analysis & Design 1 .................................... 2
QM 4851 QM Design Lab 1 CR QM 4900 Interdisciplinary Design 1 ... 1–3
QM 4860 QM Process Analysis & Design 2 .................................... 2
QM 4861 QM Design Lab 2 CR QM 4910 Interdisciplinary Design 2 ... 1–3
EN 1101 Fundamentals of Engineering I ....................................... 3
EN 1102 Fundamentals of Engineering II ...................................... 3
MA 1150 Calculus I OR MA 1160 Calculus with Technology I ........ 4
MA 2150 Calculus II CR MA 2160 Calculus with Technology II ...... 4
MA 2320 Elementary Linear Algebra .............................................. 2
MA 3150 Multivariable Calc OR MA 3160 Multivariable Calc with Tech 4
MA 3520 Elementary Differential Equations .................................. 2
PH 1100 Introductory Physics Lab I .............................................. 1
PH 1200 Introductory Physics Lab II .............................................. 1
PH 2100 Univ Physics I-Mechanics .............................................. 3
PH 2200 Univ Physics II-Electricity and Magnetism ....................... 3
Approved electives ................................................................. 10
Choose from 3 areas; include at least one CH, one QM OR other Engg, and one approved technical elective*

Concentration Requirements—0 credits

Free Electives—3 credits

General Education Requirements—28 credits
Core ................................................................. 13
UN 1001 Perspectives on Inquiry .................................................. 3
UN 1002 World Cultures ........................................................... 4
UN 2001 Revisions .................................................................. 3
UN 2002 Institutions ................................................................ 3
Note: Two semesters of a single modern language (6 cr) in addition to UN 1003 World Cultures Activities (1 cr) can substitute for UN 1002.

Distribution Courses ............................................................ 15
Students must take two courses each from two different lists, one that has World Cultures as a prerequisite and one that has Institutions as a prerequisite. The fifth course can come from any list. See the General Education section for specific lists and allowed courses. This program requires the following as a distribution course:
QM 3410 Tech Comm for Chem Engg .......................................... 3

Science/Math—Satisfied by major requirements above.

Co-Curricular Activities—3 units
Currently only PE classes qualify; units are required for graduation, but are not included in the calculation of the GPA, OR in the overall credits required for the degree.

Free Electives—4–7 credits
General Education Requirements—28 credits
See Accounting Concentration

Co-Curricular Activities—3 units
See Accounting Concentration

MIS Model Schedule—example only; actual schedule may vary. Include 3 units of co-curricular activities.

1st Year Fall
BA 1200 ................................................................. 3
BA 1700 OR Modern Lang* ..................................................... 4–5
MA Requirement ............................................................... 4–5
Lab Science ................................................................. 3–4
UN 1001 ................................................................. 3
Total ................................................................. 14–18

1st Year Spring
General Ed Distribution* .................................................. 3
General Ed Dist* OR BA 1700 .............................................. 1–3
MA Requirement ............................................................... 4–5
Modern Lang* AND UN 1003* OR UN 1002 ....................... 4
Total ................................................................. 12–15

2nd Year Fall
General Ed Distribution* .................................................. 3
BA 2100 ................................................................. 3
BA 2300 ................................................................. 3
BA 2700 ................................................................. 3
UN 2001 ................................................................. 3
UN 2002 ................................................................. 3
Total ................................................................. 18

2nd Year Spring
General Ed Distribution* .................................................. 3
BA 2110 ................................................................. 3
BA 2200 ................................................................. 3
BA 2310 ................................................................. 3
BA 2500 ................................................................. 3
EC 2000 ................................................................. 3
Total ................................................................. 18

3rd Year Fall
BA 3200 ................................................................. 3
BA 3210 ................................................................. 3
BA 3400 ................................................................. 3
MA 3600 ................................................................. 3
BA 3700 ................................................................. 3
EC 3100 ................................................................. 3
Total ................................................................. 18

3rd Year Spring
BA 3220 ................................................................. 3
BA 3610 ................................................................. 3
BA 3800 ................................................................. 3
EC 3300 ................................................................. 3
Free Elective ................................................................. 3
Technology Core** ....................................................... 3
Total ................................................................. 18

4th Year Fall
General Ed Dist* OR Free Elective ........................................ 3
BA 4200 ................................................................. 3
BA 4600 ................................................................. 2
BA 4710 ................................................................. 3
Technology Core** ....................................................... 3
Total ................................................................. 18

4th Year Spring
General Ed Distribution* .................................................. 3
BA 4210 ................................................................. 3
BA 4250 ................................................................. 3
BA 4700 ................................................................. 3
Concentration Elective ...................................................... 3
Total ................................................................. 15

* The SBE recommends that students take at least two semesters of language. Two semesters of language substitute for UN 1002. Further language study can be counted as distribution courses.
** To satisfy the technology core requirement, students may select 6 credits for ENG 2950, ENG 4950 OR 4960; or they may develop technology clusters with their advisors that correspond with their career interests.
Chemical Engineering, BS
ENGINEERING ENTERPRISE CONCENTRATION

College of Engineering

Total Credits Required: 131

<table>
<thead>
<tr>
<th>Major Requirements—86 credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH 1110 University Chemistry I .............................................</td>
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<td>CM 4120 Chemical Plant Operations Lab ..................................</td>
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* Students choosing a 4900/4910 senior design sequence in place of CM4851/4861 will satisfy the technical elective requirement.

Free Electives—3 credits

General Education Requirements—28 credits

| Core: ............................................................. | 13 |
| UN 1001 Perspectives on Inquiry ................................ | 3 |
| UN 1002 World Cultures ......................................... | 4 |
| UN 2001 Revisions ................................................ | 3 |
| UN 2002 Institutions ............................................. | 3 |
| Note: Two semesters of a single modern language (6 cr) in addition to UN 1003 World Cultures Activities (1 cr) can substitute for UN 1002. |

DISTRIBUTION COURSES ................................... 15

Approved ENG elective modules .................................. 5

| ENG 3960 Engineering Enterprise Project Work I .................. | 1 |
| ENG 3950 Engineering Enterprise Project Work II ............... | 1 |
| ENG 3951 Budgeting Entrepren Engg, 4952 Complex Comm Practices, 4953 Writing Engg Societal Context, 4954 Global Competition, 4970 Enterprise Spec Topics | |

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Basic/Minor—Satisfied by major requirements above.

Co-Curricular Activities—3 units

Currently only PE classes qualify; units are required for graduation, but are not included in the calculation of the GPA. OR in the overall credits required for the degree.
Chemistry, BS

ACS CERTIFIED CONCENTRATION

College of Sciences and Arts

Chemists do fundamental research on the properties and the reactions of substances. In the broadest sense, chemists are interested in understanding events on a molecular level, from understanding genetics as a complex series of chemical reactions involving DNA molecules to studying the solid-state chemistry involved in superconductor and semiconductor behavior. Applied research in developing technical services and formulating materials for industrial and consumer markets also provides many career opportunities for chemists. The curriculum in chemistry is designed to acquaint the student with both fundamental theory and practical techniques as a base for continued study or for a career after graduation.

Total Credits Required: 128

Major Requirements—75 credits

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<tr>
<th>Course Code</th>
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<td>Intro Physics II-Electricity and Magnetism</td>
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Concentration Requirements—3 credits

CH electives | 3 |

Free Electives—22 credits

3rd Year Fall

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General Education Requirements—28 credits

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Free Electives—22 credits

General Education Requirements—28 credits

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Free Electives—22 credits

Chemistry, BS

BIOCHEMISTRY CONCENTRATION

College of Sciences and Arts

Total Credits Required: 128

Major Requirements—75 credits

See ACS Certified Concentration

Concentration Requirements—13–17 credits

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BL 1010 Gen Bio I AND BL 1020 Gen Bio II
BL 2100 Principles of Biochemistry .......................... 3
BL 4010 Biochemistry I ........................................... 3
BL 4820 Biochemical Laboratory Techniques I ................. 3
Recommended 4000-level course:
CH 4412 Spectroscopy of Organic Chemistry .................. 3
Free Electives—8–12 credits

General Education Requirements—28 credits
See ACS Certified Concentration
Co-Curricular Activities—3 units
See ACS Certified Concentration

Biochemistry Model Schedule—See ACS Certified model schedule, which must be modified to include the Biochemistry Concentration. See your advisor. Include 3 units of co-curricular activities.

Chemistry, BS
CHEMICAL PHYSICS CONCENTRATION

College of Sciences and Arts

Total Credits Required: 128
Major Requirements—75 credits
See ACS Certified Concentration

Concentration Requirements—19 credits
PH 2300 Univ Phys I—Fluids & Thermodynamics .................. 2
PH 3300 Thermodynamics & Statistical Mechanics ................. 3
PH 2400 Univ Phys IV—Waves & Modern Physics ................. 2
PH 3410 Quantum Physics I ...................................... 3
MA 3530 Introduction to Differential Equations .................. 3
Choose 2 of the following: ...................................... 3–7
- CH 4510 Interned Physical Chem, MA 4410 Complex Variables, MA 4515
- Intro Partial Diff Equat, PH 3110 Theoretical Mechanics I, PH 3210
- Geometrical & Physical Optics, PH 3411 Quantum Physics II, PH 3440 Nuclear
- Radiation Measurements, PH 4210 Electricity & Magnetism I, PH 4430 Intro to
- Nuclear Physics, PH 4510 Intro to Solid State Physics

Free Electives—5–9 credits

General Education Requirements—28 credits
See ACS Certified Concentration

Co-Curricular Activities—3 units
See ACS Certified Concentration

Chemical Physics Model Schedule—See ACS Certified model schedule, which must be modified to include the Chemical Physics Concentration. See your advisor. Include 3 units of co-curricular activities.

Chemistry, BS
ENVIRONMENTAL CONCENTRATION

College of Sciences and Arts

Total Credits Required: 128
Major Requirements—75 credits
See ACS Certified Concentration

Concentration Requirements—16–23 credits
BL 1040 Prin of Bio OR
BL 1010 Gen Bio I AND BL 1020 Gen Bio II ......................... 4–8
Choose a minimum of 6 credits:
- BL 3210 Gen Microbio, BL 3310 Environ Microbio, BL 4040 Environ Biochem,
- CE 3501 Environ Engg Fund, GE 2000 Understanding the Earth, GE 2050
- Understanding Minerals, GE 2100 Environ Geo, GE 3300 Intro to Oceanography
Choose 2 of the following: ..................................... 6–8
- BL 4430 Bio Simulation Techniques, BL 4451 Aquatic Ecology, CE 3503
- Environ Engg, GE 4502 Traffic Engg, GE 4503 Drinking Water Treatment &
- Dist, GE 4504 Air Quality Engg & Science, GE 4505 Surf Water Quality Engg,
- GE 3200 Geochem, GE 3850 Geohydrology

Free Electives—2–9 credits

General Education Requirements—28 credits
See ACS Certified Concentration
Co-Curricular Activities—3 units
See ACS Certified Concentration

Environmental Model Schedule—See ACS Certified model schedule, which must be modified to include the Environmental Concentration. See your advisor. Include 3 units of co-curricular activities.

Chemistry, BS
POLYMERS CONCENTRATION

College of Sciences and Arts

Total Credits Required: 128
Major Requirements—75 credits
See ACS Certified Concentration

Concentration Requirements—16 credits
CH 4412 Spectroscopy of Org Chem OR CH 4990 Undergrad Res in Chemistry
- (polymer) OR CM 4650 Polymer Rheology ....................... 3
CH 4610 Introduction to Polymer Science .......................... 3
CH 4620 Polymer Chemistry ...................................... 3
CH 4631 Polymer Science Laboratory ............................. 2
CH 4641 Polymer Chemistry Laboratory ............................ 2
MY 2100 Intro to Materials Science and Engineering .......... 3

Free Electives—9 credits

General Education Requirement—28 credits
See ACS Certified Concentration
Co-Curricular Activities—3 units
See ACS Certified Concentration

Polymers Model Schedule—See ACS Certified model schedule, which must be modified to include the Polymers Concentration. See your advisor. Include 3 units of co-curricular activities.

Chemistry, BS
SECONDARY EDUCATION CONCENTRATION

College of Sciences and Arts

Total Credits Required: 128
Major Requirements—75 credits
See ACS Certified Concentration

Concentration Requirements—22–25 credits
CH 3020 Laboratory Teaching Internship .......................... 2
ED 2100 Instructional Technology .................................. 2
PSY 2000 Principles of Psychology .................................. 3
EDUCATION EVERY BLOCK—block courses must be taken concurrently
- ED 3110 Psychological Foundations of Learning .................. 2
- ED 3210 Foundations of Education ................................. 2
- ED 3310 Seminar in Education ..................................... 1
- ED 3410 Clinical Experience ....................................... 1
Choose 3 of the following: ..................................... 9–12
- BL1040 Prin of Biology; GE 2000 Understanding the Earth, GE 2050
- Understanding Minerals, GE 3300 Intro to Oceanography, MY 2100 Intro
- Materials Science & Engg, PH 2300 Univ Physics III Fluid/Thermodynamics
- AND PH 2400 Univ Phys IV-Waves/Modern Phys, PH 3210 Geometrical & Physical
- Optics
Note: To earn Michigan teacher certification, you must also take the following: ED 4810 (4),
- GE 4910 (12), HU 4150 (4), and FA 2090 (3). See Education Dept. for details.

Free Electives—0–3 credits

General Education Requirements—28 credits
See ACS Certified Concentration
Co-Curricular Activities—3 units
See ACS Certified Concentration

Chemistry Secondary Educ Model Schedule—See ACS Certified model schedule, which must be modified to include the Secondary Education Concentration. See your advisor and Dept. of Education. Include 3 units of co-curricular activities.

Civil Engineering, BS

College of Engineering

Civil engineers plan, design, build, and manage the facilities that are essential to our civilization—bridges, dams, highways, transit systems, airports, tunnels, irrigation systems, water distribution and wastewater treatment facilities, industrial and commercial buildings. They are problem solvers who manage and guide technological advances necessary for human health and well being and the protection of earth’s ecosystems. The planning, design, and construction of large, one-of-a-kind systems and structures is a hallmark of civil engineering.

Your assignments might place you at a computer workstation, in front of a public hearing, or on a project work site at the forefront of technology.

Total Credits Required: 130

Major Requirements—84 credits
CE 2201 Structural Engineering I ......................................... 3
CE 3101 Civil Engineering Materials ....................................... 3
CE 3201 Structural Engineering II ......................................... 3
CE 3331 Professional Practice ............................................. 2
CE 3332 Fundamentals of Construction Engineering .................. 3
CE 3401 Transportation Engineering ...................................... 3
CE 3503 Environmental Engineering .................................... 3
CE 3600 Fluid Mechanics .................................................. 3
CE 3610 Hydraulics ....................................................... 3
CE 3810 Soil Mechanics for Engineers .................................... 4
CE 4900* Engg Des Proj I OR CE 4905* Engg Des Proj ............... 3
CE 4910* Engg Des Proj II OR Technical Elective* .................... 4
CH 1100 General Chemistry ............................................... 4
EC 3401 Economic Decision Analysis I .................................. 1
EC 3402 Economic Decision Analysis II .................................. 1
ENG 1101 Fundamentals of Engineering I ............................... 3
ENG 1102 Fundamentals of Engineering II ............................... 3
GE 2000 Understanding the Earth ........................................ 3
MA 1150 Calculus I OR MA 1160 Calculus with Technology I ....... 4
MA 2150 Calculus II OR MA 2160 Calculus with Technology II ..... 4
MA 2330 Linear Algebra .................................................. 2
MA 3150 Multivariable Calculus ........................................... 4
MA 3520 Elementary Differential Equations ........................... 2
MA 3710 Engineering Statistics .......................................... 2
MEEM 2120 Statics Strength of Materials ................................ 4
PH 1100 Introductory Physics Lab I ..................................... 1
PH 1200 Introductory Physics Lab II ..................................... 1
PH 2100 Univ Physics I-Mechanics ...................................... 3
PH 2200 Univ Physics II-Electricity & Magnetism ..................... 3
SU 1300 Surveying Field Fundamentals .................................. 2

Concentration Requirements—15 credits
Specialty Area Electives: Must include at least one course from four of six specialty areas. See specialty area list

Free Electives—3 credits

General Education Requirements—28 credits
CORE ................................................................. 13
UN 1001 Perspectives on Inquiry ......................................... 3
UN 1002 World Cultures .................................................. 4
UN 2001 Revisions ...................................................... 3
UN 2002 Institutions ...................................................... 3
Note: Two semesters of a single modern language (6 cr) in addition to UN 1003 World Cultures Activities (1 cr) can substitute for UN 1002.

DISTRIBUTION COURSES ................................................ 15
Students must take two courses each from two different lists, one that has World Cultures as a prerequisite and one that has Institutions as a prerequisite. The fifth course can come from any list. See the General Education section for specific lists and allowed courses. This program requires the following as a distribution course:
EC 2000 Principles of Economics ........................................... 3
Science/Math—Satisfied by major requirements above.

Co-Curricular Activities—3 units
Currently only PE classes qualify; units are required for graduation, but are not included in the calculation of the GPA, or in the overall credits required for the degree.

Civil Engineering Model Schedule—example only; actual schedule may vary. Include 3 units of co-curricular activities.

1st Year Fall
CH 1100 ................................................................. 4
ENG 1101 ................................................................. 3
MA 1150 ................................................................. 4
PH 1100 ................................................................. 1
UN 1001 ................................................................. 3
Total ................................................................. 15

1st Year Spring
ENG 1102 ................................................................. 3
MA 2150 ................................................................. 4
PH 2100 ................................................................. 3
PH 2200 ................................................................. 3
UN 1002 ................................................................. 4
UN 2001 ................................................................. 3
Total ................................................................. 15

1st Year Summer
SU 1300 ................................................................. 2
EC 2000 ................................................................. 3
MA 3150 ................................................................. 4
MEEM 2120 ............................................................ 3
PH 2200 ................................................................. 3
UN 2001 ................................................................. 3
Total ................................................................. 17

2nd Year Fall
GE 2000 ................................................................. 3
MA 3150 ................................................................. 4
MEEM 2120 ............................................................ 3
PH 2200 ................................................................. 3
UN 2001 ................................................................. 3
Total ................................................................. 15

2nd Year Spring
EC 2000 ................................................................. 3
CE 3503 ................................................................. 3
CE 3810 ................................................................. 4
CE 3903 ................................................................. 3
Total ................................................................. 16

3rd Year Fall
EC 3503 ................................................................. 3
CE 3810 ................................................................. 4
CE 3903 ................................................................. 3
Total ................................................................. 16

3rd Year Spring
EC 3503 ................................................................. 3
CE 3810 ................................................................. 4
CE 3903 ................................................................. 3
Total ................................................................. 16

4th Year Fall
EC 3600 ................................................................. 3
CE 4900* OR 4905* ..................................................... 3
MA 3230 ................................................................. 2
MA 3520 ................................................................. 2
MA 3710 ................................................................. 3
UN 2002 ................................................................. 3
Total ................................................................. 16

4th Year Spring
EC 3600 ................................................................. 3
CE 4910* OR Tech Elective* ............................................. 3
MA 3230 ................................................................. 2
MA 3520 ................................................................. 2
Specialty Area Elective 3 .................................................. 3
Specialty Area Elective 1 .................................................. 3
Total ................................................................. 18

* Students who elect CE 4900 must also elect CE 4910. A two-semester senior design experience offered by other engineering departments may be selected instead of CE 4900 and CE 4910 with the approval of the academic advisor and the offering department.

Civil Engineering, BS

ENGINEERING ENTERPRISE CONCENTRATION

College of Engineering

Total Credits Required: 130

Major Requirements—86 credits
CE 2201 Structural Engineering I ......................................... 3
CE 3101 Civil Engineering Materials .................................... 3
CE 3201 Structural Engineering II ....................................... 3
CE 3332 Fundamentals of Construction Engineering ................. 3
CE 3401 Transportation Engineering .................................... 3
CE 3503 Environmental Engineering .................................... 3
CE 3600 Fluid Mechanics OR GE 3800 Earth Mechanics .......... 3
CE 3610 Hydrology ...................................................... 3
CE 3810 Soil Mechanics for Engineers .................................. 3

Civil Engineering, BS

ENGINEERING ENTERPRISE CONCENTRATION

College of Engineering

Total Credits Required: 130

Major Requirements—86 credits
CE 2201 Structural Engineering I ......................................... 3
CE 3101 Civil Engineering Materials .................................... 3
CE 3201 Structural Engineering II ....................................... 3
CE 3332 Fundamentals of Construction Engineering ................. 3
CE 3401 Transportation Engineering .................................... 3
CE 3503 Environmental Engineering .................................... 3
CE 3600 Fluid Mechanics OR GE 3800 Earth Mechanics .......... 3
CE 3610 Hydrology ...................................................... 3
CE 3810 Soil Mechanics for Engineers .................................. 3
### 1st Year Fall

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<td>Fundamentals of Engineering I</td>
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<td>ENG 1102</td>
<td>Fundamentals of Engineering II</td>
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<tr>
<td>GE 2000</td>
<td>Understanding the Earth</td>
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<tr>
<td>MA 1150</td>
<td>Calculus I OR MA 1160 Calculus with Technology I</td>
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<tr>
<td>MA 2150</td>
<td>Calculus II OR MA 2160 Calculus with Technology II</td>
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<td>MA 2220</td>
<td>Elementary Linear Algebra</td>
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<tr>
<td>MA 3150</td>
<td>Multivariable Calculus</td>
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<tr>
<td>MA 3520</td>
<td>Elementary Differential Equations</td>
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<td>MA 3710</td>
<td>Engineering Statistics</td>
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<td>MEEM 2120</td>
<td>Statics Strength of Materials</td>
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<td>PH 1200</td>
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<td>PH 2100</td>
<td>Univ Physics I-Mechanics</td>
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<td>PH 2200</td>
<td>Univ Physics II-Electricity &amp; Magnetism</td>
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<td>SU 1300</td>
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#### See Specialty Area List

<table>
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<tr>
<td>EC 2000 Principles of Economics</td>
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<tr>
<td>ENG 2950 Engineering Enterprise Orientation</td>
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<tr>
<td>ENG 2960 Engineering Enterprise Project Work I</td>
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<td>ENG 3960 Engineering Enterprise Project Work III</td>
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<td>ENG 4950 Engineering Enterprise Project Work IV</td>
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<tr>
<td>ENG 4960 Engineering Enterprise Project Work V</td>
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#### Approved ENG elective modules

- EN 3401 Econ Decision Analy I
- EN 3402 Econ Decision Analy II
- EN 3403 Econ Decision Analy III
- EN 3954 Enterprise Market Prin
- EN 3955 Concept Design Prob Solving
- EN 3956 Industrial Health and Safety
- EN 3961 Engg Ent Strat Leadership
- EN 3964 Proj Management
- EN 3965 Material Flow Ind Society
- EN 3966 Des for Manufacturing
- EN 3970 Enterprise Spec Topics
- EN 4951 Budgeting Entreprent Engg
- EN 4952 Complex Comm Practices
- EN 4953 Writing Engg Societal Context
- EN 4954 Global Competition
- EN 4970 Enterprise Spec Topics

<table>
<thead>
<tr>
<th>Free Electives—0 credits</th>
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</thead>
</table>

#### General Education Requirements—28 credits

- **CORE**                         | 13 |
- UN 1001 Perspectives on Inquiry | 3  |
- UN 1002 World Cultures          | 4  |
- UN 2001 Revisions               | 3  |
- UN 2002 Institutions            | 3  |

Note: Two semesters of a single modern language (6 cr) in addition to UN 1003 World Cultures Activities (1 cr) can substitute for UN 1002.

#### DISTRIBUTION COURSES

Students must take two courses each from two different lists, one that has World Cultures as a prerequisite and one that has Institutions as a prerequisite. The fifth course can come from any list. See the General Education section for specific lists and allowed courses. This program requires the following in place of the fifth course:

- ENG 2961 Teaching in the Engineering Enterprise | 1 |
- ENG 2962 Communication Contexts                | 1 |
- ENG 3962 Communication Strategies              | 1 |

#### SCIENCE/MATH—Satisfied by major requirements above.

#### Co-Curricular Activities—3 units

Currently only PE classes qualify; units are required for graduation, but are not included in the calculation of the GPA, or in the overall credits required for the degree.

#### Civil Engg Enterprise Model Schedule—example only; actual schedule may vary.

<table>
<thead>
<tr>
<th>1st Year Fall</th>
<th>1st Year Spring</th>
<th>2nd Year Fall</th>
<th>3rd Year Spring</th>
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<tr>
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<td>ENG 1102</td>
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<td>ENG 1101</td>
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<td>MEEM 2120</td>
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<td>UN 1002</td>
<td>UN 2001</td>
<td>UN 3960</td>
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<td>16</td>
<td>15</td>
<td>18</td>
<td>16–17</td>
</tr>
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</table>

#### 1st Year Summer

| SU 1300 | 2 |

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### Clinical Laboratory Science, BS

#### 3+1 CLS CONCENTRATION

**College of Sciences and Arts**

Clinical laboratory science (medical technology) offers an exciting variety of career possibilities for students who wish to become medically oriented biological scientists. Numerous and varied employment opportunities exist because there is currently a shortage of qualified medical laboratory personnel. Clinical laboratory scientists use their understanding of biology and biochemistry to perform and develop laboratory test procedures. These procedures may be used to verify health, diagnose or monitor disease, make or test new medically related products, or contribute valuable information to research projects. At MTU, you can pursue a BS in Clinical Laboratory Science.

**Total Credits Required: 131**

**Major Requirements—66 credits**

- **BA 1200** ISIT Fund CR CS 1121 Intro to CS I | 3 |
- **BL 0600** Practicum and Career Prep* | 1 |
- **BL 1020** General Biology II | 4 |
- **BL 1600** Introduction to Clinical Laboratory Science | 1 |
- **BL 1710** Medical Terminology | 1 |
- **BL 2010** Anatomy & Physiology I | 3 |
- **BL 2011** Anatomy & Physiology I Lab | 1 |
- **BL 2020** Anatomy & Physiology II | 3 |
- **BL 2021** Anatomy & Physiology II Lab | 1 |
- **BL 2100** Principles of Biochemistry | 3 |
- **BL 2220** Genetics | 3 |
- **BL 2410** Basic Clinical Laboratory Techniques | 3 |
- **BL 3210** General Microbiology | 4 |
- **BL 3230** Medical Bacteriology | 3 |
- **BL 3640** General Immunology | 3 |
- **BL 3780** Medical Parasitology Laboratory | 1 |
- **BL 4550** Clinical Chemistry | 3 |
- **BL 4640** Clinical Immunology & Serology | 2 |
- **BL 4710** Hematology & Immunohematology | 4 |
- **BL 4750** Clinical Laboratory Instrumentation | 2 |
- **BL 4980** CLS Core Concept Integration and Application | 2 |
- **CH 1110** University Chemistry I | 4 |
- **CH 1111** University Chemistry Lab I | 1 |
Clinical Laboratory Science, BS

| 3+1 CYTO TECHNOLOGY CONCENTRATION |

**College of Sciences and Arts**

- **Total Credits Required:** 131
- **Major Requirements:** 66 credits
  - See 3+1 CLS Concentration
- **Concentration Requirements:** 33 credits
  - BL 2210 Genetics Laboratory
  - BL 4620 Histotechnology Practicum I
  - BL 4621 Histotechnology Practicum II
  - PH 1200 Introductory Physics Lab II
  - PH 1210 College Physics II
- **Free Electives:** 4 credits
- **General Education Requirements:** 28 credits
  - See 3+1 CLS Concentration
- **Co-Curricular Activities:** 3 units
  - See 3+1 CLS Concentration
- **3+1 Histotechnology Model Schedule:** See 3+1 CLS Concentration. Include 3 units of co-curricular activities.

Clinical Laboratory Science, BS

| 3+1 HISTOTECHNOLOGY CONCENTRATION |

**College of Sciences and Arts**

- **Total Credits Required:** 131
- **Major Requirements:** 66 credits
  - See 3+1 CLS Concentration
- **Concentration Requirements:** 36 credits
  - BL 4320 Histology
  - BL 4630 Histotechnology Practicum I
  - BL 4631 Histotechnology Practicum II
  - PH 1200 Introductory Physics Lab II
  - PH 1210 College Physics II
- **Free Electives:** 1 credit
- **General Education Requirements:** 28 credits
  - See 3+1 CLS Concentration
- **Co-Curricular Activities:** 3 units
  - See 3+1 CLS Concentration
- **3+1 Histotechnology Model Schedule:** See 3+1 CLS Concentration. Include 3 units of co-curricular activities.

Clinical Laboratory Science, BS

| 4+1 CLS CONCENTRATION |

**College of Sciences and Arts**

- **Total Credits Required:** 128
- **Major Requirements:** 66 credits
  - See 3+1 CLS Concentration
- **Concentration Requirements:** 33 credits
  - BL 2210 Genetics Laboratory
  - BL 4030 Molecular Biology
  - BL 4740 Introduction to Mycology
  - BL 4840 Molecular Biology Techniques
  - BL 4979 Clinical Lab Admin and Management
  - MA 2710 Introduction to Statistical Analysis
  - PH 1100 Introductory Physics Lab I
  - PH 1210 College Physics I
  - PH 1210 College Physics II
- **Free Electives:** 3 credits
- **General Education Requirements:** 28 credits
  - See 3+1 CLS Concentration
- **Co-Curricular Activities:** 3 units
  - See 3+1 CLS Concentration
- **4+1 CLS Concentration Model Schedule:** See 3+1 CLS Concentration. Include 3 units of co-curricular activities.
Clinical Laboratory Science, BS

**Clinical Laboratory Science, BS**

**4+1 CYTOTECHNOLOGY CONCENTRATION**

**College of Sciences and Arts**

**Total Credits Required:** 128

**Major Requirements—66 credits**

See 3+1 CLS Concentration

**Concentration Requirements—32 credits**

<table>
<thead>
<tr>
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<th>Course Title</th>
<th>Credits</th>
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<tbody>
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<tr>
<td>BL 4010</td>
<td>Biochemistry I</td>
<td>.3</td>
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<td>BL 4030</td>
<td>Molecular Biology</td>
<td>.3</td>
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<td>BL 4740</td>
<td>Introduction to Mycology</td>
<td>.3</td>
</tr>
<tr>
<td>BL 4979</td>
<td>Clinical Lab Administration and Management</td>
<td>.2</td>
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<tr>
<td>BL 5050</td>
<td>Electronic Optical Methods of Analysis II: Principles and Techniques for Biologists</td>
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</table>

**Free Electives—2 credits**

See 3+1 CLS Concentration

**Total Credits Required:** 146

**Secondary Education—Biology Concentration (4+1)**

**College of Sciences and Arts**

**Total Credits Required:** 146

**Major Requirements—66 credits**

See 3+1 CLS Concentration

**Concentration Requirements—52 credits**

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<td>BL 4030</td>
<td>Molecular Biology</td>
<td>.3</td>
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<tr>
<td>BL 4979</td>
<td>Clinical Laboratory Admin &amp; Management</td>
<td>.2</td>
</tr>
<tr>
<td>MA 2710</td>
<td>Introduction to Statistical Analysis</td>
<td>.3</td>
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<tr>
<td>PH 1110</td>
<td>Introductory Physics Lab I</td>
<td>.1</td>
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<td>College Physics I</td>
<td>.3</td>
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<tr>
<td>HU 4150</td>
<td>Literacy in the Content Areas</td>
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</table>

**Free Electives—4 credits**

See 3+1 CLS Concentration

**Total Credits Required:** 146

**Clinical Laboratory Science, BS**

**4+1 HISTOTECHNOLOGY CONCENTRATION**

**College of Sciences and Arts**

**Total Credits Required:** 128

**Major Requirements—66 credits**

See 3+1 CLS Concentration

**Concentration Requirements—30 credits**

<table>
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<tr>
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<th>Course Title</th>
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<tbody>
<tr>
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<tr>
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<tr>
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<td>PH 1210</td>
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</table>

**Free Electives—4 credits**

See 3+1 CLS Concentration

**Total Credits Required:** 128

**Clinical Laboratory Science, BS**

**Co-Curricular Activities—3 units**

*Required, but does not count in the overall degree requirements total.
**CLS (BL 4010 AND BL 4230 AND BL 4470) OR (BA 2700 AND EC 2000 AND EC 4700), and 1 free elective: Histotechnology (BL 4010 AND BL 4230, and 4 free electives); Cytotechnology (BL 4010 AND BL 5050 AND BL 5060, and 2 free electives).*
Computer Engineering, BS

**College of Engineering**

Computer engineers work in the middle ground between digital hardware and software. Through this program, you will gain a wide range of skills that span the traditional areas of electrical engineering, computer engineering, and computer science. The fields of electrical and computer engineering are experiencing major shifts in emphasis from analog to digital electronics and from fixed to programmable digital hardware. Our program focuses on the new world of embedded systems and programmable digital system design, with an emphasis on digital signal processing (DSP) solutions. As a graduate, you’ll enter a fast-moving field and a fast-growing job sector.

### Computer Engineering Model Schedule

**First Year**

<table>
<thead>
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<th>Fall</th>
<th>Spring</th>
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<tbody>
<tr>
<td>BL 1010</td>
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**Second Year**

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**Third Year**

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<tr>
<td>Total (16 credits)</td>
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</table>

**Free Electives**

- 3 credits

**General Education Requirements—28 credits**

- 11 credits
- 1 credit
- 7 credits
- 3 credits

**Co-Curricular Activities—3 units**

- 3 units

**Total Credits Required: 131**

**Core**

- 13 credits

**Univ System Requirements**

- 14 credits

**UN 1003 World Cultures**

- 4 credits

**Total (15 credits)**

**DISTRIBUTION COURSES**

- 15 credits

Students must take two courses each from two different lists, one that has World Cultures as a prerequisite and one that has Institutions as a prerequisite. The fifth course can come from any list. See the General Education section for specific lists and allowed courses.

**Science/MATH—Satisfy by major requirements above.**

**Co-Curricular Activities—3 units**

- 3 units

**Total (18 credits)**

**Free Electives—3 credits**

**General Education Requirements—28 credits**

**UN 1001 Perspectives on Inquiry**

- 3 credits

**UN 1002 World Cultures**

- 4 credits

**UN 1001 Revisions**

- 3 credits

**UN 2002 Institutions**

- 3 credits

**Note:** Two semesters of a single modern language (6 cr) in addition to UN 1003 World Cultures Activities (1 cr) can substitute for UN 1002.

**Computer Engineering Model Schedule**

**First Year**

<table>
<thead>
<tr>
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<tbody>
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**Second Year**

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<tbody>
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**Third Year**

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<tbody>
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**Fourth Year**

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<tr>
<td>BL 4030</td>
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<td>BL 4650</td>
<td>BL 4640</td>
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<td>BL 4710</td>
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<td>HU 4150</td>
<td>PH 4150</td>
</tr>
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</table>

**Free Electives**

- 3 credits

**General Education Requirements—28 credits**

**UN 1003 World Cultures**

- 4 credits

**Total (15 credits)**

**DISTRIBUTION COURSES**

- 15 credits

Students must take two courses each from two different lists, one that has World Cultures as a prerequisite and one that has Institutions as a prerequisite. The fifth course can come from any list. See the General Education section for specific lists and allowed courses.

**Science/MATH—Satisfy by major requirements above.**

**Co-Curricular Activities—3 units**

- 3 units

**Total (18 credits)**

**Free Electives—3 credits**

**General Education Requirements—28 credits**

**UN 1003 World Cultures**

- 4 credits

**Total (15 credits)**

**DISTRIBUTION COURSES**

- 15 credits

Students must take two courses each from two different lists, one that has World Cultures as a prerequisite and one that has Institutions as a prerequisite. The fifth course can come from any list. See the General Education section for specific lists and allowed courses.

**Science/MATH—Satisfy by major requirements above.**

**Co-Curricular Activities—3 units**

- 3 units

**Total (18 credits)**
### Computer Engineering, BS

**Computer Engineering Enterprise Concentration**

#### College of Engineering

**Total Credits Required: 131**

**Major Requirements—87 credits**

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<td>General Chemistry OR CH 1110 University Chemistry I</td>
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<td>CS 1121</td>
<td>Intro to CS I AND CS 1122 Intro to CS II AND CS 2321 Found I OR CS 1131 Comp Sci I AND CS 1132 Comp Sci II</td>
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<td>CS 2322</td>
<td>Foundations II</td>
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<tr>
<td>CS 4411</td>
<td>Intro to Operating Systems</td>
<td>4</td>
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<tr>
<td>CS 4431</td>
<td>Advanced Computer Architecture</td>
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<td>EE 2110</td>
<td>Electric Circuits</td>
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<td>EE 2150</td>
<td>Introduction to Signal Processing</td>
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<td>EE 2160</td>
<td>Linear Systems Analysis</td>
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<tr>
<td>EE 2170</td>
<td>Digital Systems</td>
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<tr>
<td>EE 2301</td>
<td>EE Lab 1</td>
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<tr>
<td>EE 2302</td>
<td>EE Lab 2</td>
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<td>EE 3130</td>
<td>Electronics</td>
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<tr>
<td>EE 3140</td>
<td>Electromagnetics</td>
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<td>Microprocessors</td>
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<td>Digital Signal Processing</td>
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<td>EE 4273</td>
<td>Embedded Systems and Microprocessor Interfacing</td>
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<td>ENG 1101</td>
<td>Fundamentals of Engineering I</td>
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<td>ENG 1102</td>
<td>Fundamentals of Engineering II</td>
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<td>MA 1160</td>
<td>Calculus w/Calculus Plus w/Calculus</td>
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<td>MA 3160</td>
<td>Multivariable Calculus</td>
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<td>MA 3520</td>
<td>Elementary Differential Equations</td>
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<td>MA 3720</td>
<td>Probability</td>
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<td>PH 1100</td>
<td>Introductory Physics Lab I</td>
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<td>Introductory Physics Lab II</td>
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<tr>
<td>PH 2100</td>
<td>University Physics I-Mechanics</td>
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<td>PH 2200</td>
<td>University Physics II-Elec &amp; Magnetism</td>
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**Concentration Requirements—13 credits**

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<th>Course Title</th>
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<td>ENG 2950</td>
<td>Engineering Enterprise Orientation</td>
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<tr>
<td>ENG 2960</td>
<td>Engineering Enterprise Project Work I</td>
<td>.1</td>
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<td>Engineering Enterprise Project Work II</td>
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<td>ENG 3960</td>
<td>Engineering Enterprise Project Work III</td>
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<td>ENG 4950</td>
<td>Engineering Enterprise Project Work IV</td>
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**ENG 4960** Engineering Enterprise Project Work V          .2

**Approved elective modules**

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<td>ENG 3401</td>
<td>Econ Decision Analy I</td>
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<td>ENG 3402</td>
<td>Econ Decision Analy II</td>
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<tr>
<td>ENG 3403</td>
<td>Econ Decision Analy III</td>
<td>.5</td>
</tr>
<tr>
<td>ENG 3954</td>
<td>Enterprise Market Principles</td>
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<tr>
<td>ENG 3955</td>
<td>Concept Des</td>
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</tr>
<tr>
<td>ENG 3956</td>
<td>Problem Solving</td>
<td>.5</td>
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<tr>
<td>ENG 3961</td>
<td>Industrial Safety</td>
<td>.5</td>
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<tr>
<td>ENG 3964</td>
<td>Project Leadership</td>
<td>.5</td>
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<td>ENG 3965</td>
<td>Material Industry</td>
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<td>ENG 3966</td>
<td>Design for Manufacturing</td>
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<td>ENG 3970</td>
<td>Enterprise Spec Topics</td>
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<td>ENG 3971</td>
<td>Budgeting Enterprises</td>
<td>.5</td>
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<td>ENG 4925</td>
<td>Complex Comm Practices</td>
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<tr>
<td>ENG 4953</td>
<td>Writing Societal Context</td>
<td>.5</td>
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<td>ENG 4954</td>
<td>Global Competition</td>
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<td>ENG 4970</td>
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**Free Electives—3 credits**

**General Education Requirements—28 credits**

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<th>Course Code</th>
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<td>Perspectives on Inquiry</td>
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<td>UN 1002</td>
<td>World Cultures</td>
<td>.4</td>
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<td>UN 2001</td>
<td>Revisions</td>
<td>.3</td>
</tr>
<tr>
<td>UN 3002</td>
<td>Institutions</td>
<td>.3</td>
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</table>

**Note:** Two semesters of a single modern language (6 cr.) in addition to UN 1002 World Cultures Activities (1 cr.) can substitute for UN 1002.

**DISTRIBUTION COURSES**

Students must take two courses each from two different lists, one that has World Cultures as a prerequisite and one that has Institutions as a prerequisite. The fifth course can come from any list. See the General Education section for specific lists and allowed courses. This program requires the following in place of the fifth course:

**ENG 2951** Training in the Engineering Enterprise

**ENG 2962** Communication Contexts

**ENG 3962** Communication Strategies

**SCIENCE/MATH**—Satisfied by major requirements above.

**Co-Curricular Activities—3 units**

Currently only PE classes qualify; units are required for graduation, but are not included in the calculation of the GPA or in the overall credits required for the degree.

**Computer Engineering Enterprise Model Schedule**—Example only; actual schedule may vary. Include 3 units of co-curricular activities.

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<td>1st Year Spring</td>
<td>CS 1131</td>
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<td>MA 2160</td>
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<td>ENG 4960</td>
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**Baccalaureate Degree Requirements** 23
Computer Science, BS

Computer Science Concentration

College of Sciences and Arts

Computer Science—covers a broad spectrum of computer science, prepares students for a wide range of careers in industry; recommended for those interested in graduate studies.

Total Credits Required: 120

Major Requirements—55–58 credits

<table>
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<td>CS 1000</td>
<td>Computer Science Orientation</td>
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<td>CS 1121</td>
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<tr>
<td>CS 2322</td>
<td>Foundations II</td>
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<tr>
<td>CS 3141</td>
<td>System Software Project</td>
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<tr>
<td>CS 4121</td>
<td>Programming Languages</td>
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<tr>
<td>CS 4411</td>
<td>Introduction to Operating Systems</td>
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<tr>
<td>CS 4000-level elective*</td>
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<tr>
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<td>(may be satisfied by CS 4099)</td>
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<tr>
<td>CS 4000-level elective*</td>
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<td>(may NOT be satisfied by CS 4099)</td>
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<tr>
<td>MA 1090</td>
<td>Functions, Change, and Chance</td>
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<tr>
<td>SS 2800</td>
<td>Science, Technology, and Society</td>
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<tr>
<td>Lab Science</td>
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Concentration Requirements—26–27 credits

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<td>CS 4000-level elective*</td>
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<td>3–4</td>
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<td></td>
<td>(may NOT be satisfied by CS 4099)</td>
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<tr>
<td>MA 1160</td>
<td>Calc with Tech I OR MA 1161 Calc Plus w/ Tech I</td>
<td>4–5</td>
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<tr>
<td>MA 2160</td>
<td>Calculus with Technology II</td>
<td>4</td>
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<td>MA 2330</td>
<td>Honors Elementary Linear Algebra</td>
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<tr>
<td>MA 2710</td>
<td>Intro to Statistical Analysis OR MA 3710 Engg Statistics</td>
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<td>MA Elective</td>
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<td>3</td>
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<tr>
<td>CS Technical Elective*</td>
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Free Electives—7–11 credits

General Education Requirements—28 credits

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Concentration Requirements 26–29 credits

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<td>Introduction to Algorithms</td>
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<td>MA 1135</td>
<td>Calculus for Life Sciences</td>
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<td>MA 2710</td>
<td>Introduction to Statistical Analysis</td>
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Free Electives—5–11 credits

General Education Requirements—28 credits

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</table>

Applications Model Schedule—See Computer Science Concentration, which must be modified to include the Application Concentration. See your advisor. Include 3 units of co-curricular activities.

Computer Science, BS

Applications Concentration

College of Sciences and Arts

Applications—applies computer science in other fields, such as engineering, physics, or forestry.

Total Credits Required: 120

Major Requirements—55–58 credits

See Computer Science Concentration

Concentration Requirements 26–29 credits

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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<tbody>
<tr>
<td>CS 4321</td>
<td>Introduction to Algorithms</td>
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<td>MA 1135</td>
<td>Calculus for Life Sciences</td>
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<td>MA 2710</td>
<td>Introduction to Statistical Analysis</td>
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Free Electives—5–11 credits

General Education Requirements—28 credits

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</table>

Applications Model Schedule—See Computer Science Concentration, which must be modified to include the Application Concentration. See your advisor. Include 3 units of co-curricular activities.

Computer Science, BS

Information Systems Concentration

Applications—oriented toward business applications in directing and operating activities of government, business, and industry.

Total Credits Required: 120

Major Requirements 55–58 credits

See Computer Science Concentration

Concentration Requirements—31–32 credits

<table>
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<th>Course Title</th>
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<tr>
<td>BA 2300</td>
<td>Accounting Principles</td>
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Economics, BS
School of Business and Economics

Economics majors have the options of pursuing a broad curriculum mixing engineering, science, mathematics, social science, and/or business curricula with the study of economics. Electives allow students to design studies along one of the following paths: applied economics, business economic analysis, or pre-professional preparation. The applied economics path provides skills needed to analyze economic issues related to natural resources, the environment, international trade and finance, and governmental decision making. The business economics analysis path focuses on skills needed to analyze business decision making. The pre-professional path prepares students for graduate study in economics (MS, PhD), law (JD), business administration (MBA), or public administration (MPA). Graduates are employed in government, business, and other organizations that require analytical and problem-solving skills. Many graduates pursue further professional or graduate education for careers in law, public administration, academia, and industry. Future career trends include opportunities arising from the increasing importance of the global economy, a growing need for economic analysis of natural resource and environmental issues, and analysis of e-commerce and other emerging technologies.

Total Credits Required: 128
Major Requirements—60–62 credits

1st Year Fall
- BA 2310 Accounting Principles II ........................................... 3
- MA 3790 Business Communication OR HU 3120 Tech and Sci Comm. 3–6
- EC 3010 History of Economic Thought .................................... 3
- MA 2710 Introduction to Statistical Analysis ........................... 3
- CS 4421 Database Systems .......................................................... 4
- MA 1135 Calculus for Life Sciences ......................................... 4
- Free Elective ............................................................................. 3

1st Year Spring
- MA Requirement ........................................................................... 3–5
- EC 3020 History of Economic Thought .................................... 3
- BA 2500 OR 3690 ........................................................................ 3
- MA 2710 Introduction to Statistical Analysis ........................... 3
- Free Elective ............................................................................. 3

2nd Year Fall
- BA 2310 Accounting Principles II ........................................... 3
- MA 3790 Business Communication OR HU 3120 Tech and Sci Comm. 3–6
- EC 3010 History of Economic Thought .................................... 3
- MA 2710 Introduction to Statistical Analysis ........................... 3
- CS 4421 Database Systems .......................................................... 4
- MA 1135 Calculus for Life Sciences ......................................... 4
- Free Elective ............................................................................. 3

2nd Year Spring
- MA Requirement ........................................................................... 3–5
- EC 3020 History of Economic Thought .................................... 3
- BA 2500 OR 3690 ........................................................................ 3
- MA 2710 Introduction to Statistical Analysis ........................... 3
- Free Elective ............................................................................. 3

3rd Year Fall
- Lab Science (BL, CH, FW, GE, OR PH) ....................................... 4
- Modern Language* ..................................................................... 6

Choose from the following: ...................................................... 15

3rd Year Spring
- General Ed Distribution ................................................................. 3
- MA Requirement ........................................................................... 3–5
- Modern Language AND UN 1003* OR UN 1002* .................. 3
- Free Elective ............................................................................. 3

4th Year Fall
- Lab Science (BL, CH, FW, GE, OR PH) ....................................... 4
- Modern Language* ..................................................................... 6

Choose from the following: ...................................................... 15

4th Year Spring
- General Ed Distribution ................................................................. 3
- MA Requirement ........................................................................... 3–5
- Modern Language AND UN 1003* OR UN 1002* .................. 3
- Free Elective ............................................................................. 3

* Other courses may be substituted with advisor approval.
** No more than 32 BA credits, including required BA courses, can be counted toward the degree.
## Electrical Engineering, BS

**College of Engineering**

**Total Credits Required: 128**

### Major Requirements—97 credits

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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</tr>
</thead>
<tbody>
<tr>
<td>CH 1100</td>
<td>General Chem OR CH 1110 Univ Chem I</td>
<td>4</td>
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<tr>
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<td>Intro to CS I OR CS 1131 CS I</td>
<td>3–4</td>
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<tr>
<td>EE 2110</td>
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<td>EE 2150</td>
<td>Introduction to Signal Processing</td>
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<tr>
<td>EE 2160</td>
<td>Linear Systems Analysis</td>
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<tr>
<td>EE 2170</td>
<td>Digital Systems</td>
<td></td>
</tr>
<tr>
<td>EE 2301</td>
<td>EE Lab 1</td>
<td>1</td>
</tr>
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<td>EE 2302</td>
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<td>Electric Energy Systems</td>
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### Engineering Design

Choose 6 credits of departmentally approved engineering design courses from within the College of Engineering. See department advisor for more information.

### Concentration Requirements—0 credits

### Free Electives—3 credits

### General Education Requirements—28 credits

**CORE**                                                   | 13  |
| UN 1001 Perspectives on Inquiry                           | 3   |
| UN 1002 World Cultures                                    | 4   |
| UN 2001 Revisions                                         | 3   |
| UN 2002 Institutions                                      | 3   |

Note: Two semesters of a single modern language (6 cr) in addition to UN 1003 World Cultures Activities (1 cr) can substitute for UN 1002.

**DISTRIBUTION COURSES**                                  | 15  |

Students must take two courses each from two different lists, one that has World Cultures as a prerequisite and one that has Institutions as a prerequisite. The fifth course can come from any list. See the General Education section for specific lists and allowed courses.

**SCIENCE/MATH**—Satisfied by major requirements above.

### Co-Curricular Activities—3 units

Currently only PE classes qualify; units are required for graduation, but are not included in the calculation of the GPA, or in the overall credits required for the degree.

### Technical Electives—3 credits

Choose any EE course not listed above, numbered >3000 and <4000, and which is not a design course.

---

### Electrical Engineering Model Schedule—example only; actual schedule may vary. Include 3 units of co-curricular activities.

#### 1st Year Fall

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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<tbody>
<tr>
<td>CH 1100</td>
<td>General Chem OR CH 1110 Univ Chem I</td>
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<td>Electric Circuits</td>
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<tr>
<td>EE 2150</td>
<td>Introduction to Signal Processing</td>
<td></td>
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<tr>
<td>MA 1160</td>
<td>Calc with Tech I OR MA 1161 Calc Plus with Tech I</td>
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<td>PH 1100</td>
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**Electrical Engineering, BS**

**ENGINEERING ENTERPRISE CONCENTRATION**

**College of Engineering**

**Total Credits Required: 128**

### Major Requirements—84 credits

<table>
<thead>
<tr>
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<td>Choose any EE course not listed above, numbered &gt;3000 and &lt;4000, and which is not a design course.</td>
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### 3rd Year Fall

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<tr>
<td><strong>Total</strong></td>
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**Electrical Engineering, BS**

**Total Credits Required: 128**

### Major Requirements—84 credits

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<td>Choose any EE course not listed above, numbered &gt;3000 and &lt;4000, and which is not a design course.</td>
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### 3rd Year Fall

<table>
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<tr>
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</table>
PH 1200 Introductory Physics Lab II ..................................1
PH 2100 Univ Physics I—Mechanics ..................................3
PH 2200 Univ Physics II—Elec & Magnetism ......................3
Technical Electives ..................................................3
A technical elective is any EE elective course, any College of Engg. course numbered 2000 and above, any CS course with a CS 1121/1131 prereq, any math course with MA 1150/1160 prereq, any physics course with a PH 2100 prereq, any chemistry course with a CH 1100/1110 prereq, Engineering Economics, or Engineering Co-op (max 3 cr).

Concentration Requirements—13 credits
ENG 2950 Engineering Enterprise Orientation ..................1
ENG 2950 Engineering Enterprise Project Work I ..............1
ENG 3950 Engineering Enterprise Project Work II ..............1
ENG 4950 Engineering Enterprise Project Work III ............1
ENG 4960 Engineering Enterprise Project Work IV .............2
Approved ENG elective modules ....................................5
Engg, 4952 Complex Comm Practices, 4953 Writing Engg Societal Context, 4954 Global Competition, 4970 Enterprise Spec Topics
Free Electives—3 credits

General Education Requirements—28 credits
CPE: ........................................................................13
UN 1001 Perspectives on Inquiry ..................................3
UN 1002 World Cultures .............................................4
UN 2001 Revisions ...................................................3
UN 2002 Institutions ..................................................3
Note: Two semesters of a single modern language (6 cr) in addition to UN 1003 World Cultures Activities (1 cr) can substitute for UN 1002.

DISTRIBUTION COURSES ...........................................15
Students must take two courses each from two different lists, one that has World Cultures as a prerequisite and one that has Institutions as a prerequisite. The fifth course can come from any list. See the General Education section for specific lists and allowed courses. This program requires the following in the fifth course:
ENG 2961 Teamwork in the Engineering Enterprise ..........1
ENG 2962 Communication Contexts ................................1
ENG 3962 Communication Strategies ............................1
Science/Math—Satisfied by major requirements above.

Co-Curricular Activities—3 units
Currently only PE classes qualify; units are required for graduation, but are not included in the calculation of the GPA or in the overall credits required for the degree.

Electrical Engineering Enterprise Model Schedule—example only; actual schedule may vary. Include 3 units of co-curricular activities.

1st Year Fall
CH 1100 ..................................................4
ENG 1101 .................................................3
MA 1160 ..................................................4
PH 1100 ..................................................1
UN 1001 ..................................................3
Total .....................................................15

1st Year Spring
CS 1121 ..................................................3
ENG 1102 ..................................................3
MA 2160 ..................................................4
PH 2100 ..................................................3
UN 1002 ..................................................4
Total .....................................................17

2nd Year Fall
EE 2150 ..................................................3
EE 2170 ..................................................3
EE 2301 ..................................................1
ENG 2950 ..................................................1
MA 2230 ..................................................2
MA 3230 ..................................................2
PH 1200 ..................................................1
UN 2001 ..................................................3
Total .....................................................16

2nd Year Spring
EE 2110 ..................................................3
EE 2160 ..................................................3
EE 2302 ..................................................1
ENG 2960 ..................................................1
ENG 2961 ..................................................1
ENG 2962 ..................................................1
MA 3160 ..................................................4
PH 2200 ..................................................3
Total .....................................................17

3rd Year Fall
EE 3130 ..................................................3
EE 3170 ..................................................3
EE 3301 ..................................................1
ENG 3950 ..................................................1
ENG Electives ..................................................1–2
MA 3720 ..................................................3
UN 2002 ..................................................3
Total .....................................................16–17

3rd Year Spring
EE 3120 ..................................................3
EE 3140 ..................................................3
EE 3150 ..................................................3
EE 3302 ..................................................1
ENG 3960 ..................................................1
ENG Electives ..................................................1–2
Technical Elective ..................................................3
Total .....................................................15–16

4th Year Spring
General Ed Distribution ..........................................3
General Ed Distribution ..........................................3
ENG 4950 ..................................................2
EE Elective ..................................................1–2
EE Elective ..................................................1–2
Free Elective ..................................................3
Total .....................................................16–17

Total Credits Required: 127

Major Requirements—82 credits
CET 1100 Intro to Computing & Technical Drawing ..........3
EET 1111 Circuits I .........................................3
EET 1112 Circuits I Laboratory ................................1
EET 2111 Circuits II .........................................3
EET 2112 Circuits II Laboratory ................................1
EET 2141 Digital Electronics & Microprocessor Fundamentals ..........4
EET 2221 Electronic Devices and Circuit Theory ............3
EET 2222 Electronic Devices and Circuits Laboratory ....1
EET 2233 Electrical Machinery ..................................4
EET 3225 Special Electronic Devices ..........................4
EET 3267 Communications Systems ............................3
EET 3268 Communications Systems Laboratory ..............1
EET 3281 Electrical Proj Dev and Troubleshooting ..........3
EET 3353 Sensors, Data Acquisition and Control ..........4
EET 3373 Introduction to Programmable Controllers .......3
EET 4480 Senior Project .......................................6
EET 4480 Senior Project* .....................................4
Choose 7 credits from the following: .........................7
MAT 1115 Technical Mathematics I ..........................5
MAT 1125 Technical Mathematics II ..........................5
MAT 2215 Technical Mathematics III ..........................3
MAT 3225 Technical Mathematics IV ..........................3
PH 1100 Introductory Physics Lab I ............................1
RH 1110 College Physics I .....................................3
Science Elective ..................................................4

Engineering Technology, BS
ELECTRICAL ENGINEERING TECHNOLOGY CONCENTRATION
School of Technology

The BS degree in Electrical Engineering Technology provides a path for Electrical or Electromechanical Engineering Technology AAS degree graduates to earn a four-year degree in two additional years. BS graduates are referred to as engineering technologists and are prepared for jobs in engineering that are more applications oriented. The BS degree requires 18 additional Gen Ed credits beyond the 10 Gen Ed credits required for the AAS. Additional courses in mathematics and technical specialty courses are also required as is a 6-credit hour capstone senior project. Opportunity exists to specialize in computer networking, programmable logic controllers (PLCs), wireless communications, and data acquisition and control. Work activities can be in network administration, plant engineering, communications engineering, testing, and product development.

Total Credits Required: 127

Major Requirements—82 credits
CET 1100 Intro to Computing & Technical Drawing ..........3
EET 1111 Circuits I .........................................3
EET 1112 Circuits I Laboratory ................................1
EET 2111 Circuits II .........................................3
EET 2112 Circuits II Laboratory ................................1
EET 2141 Digital Electronics & Microprocessor Fundamentals ..........4
EET 2221 Electronic Devices and Circuit Theory ............3
EET 2222 Electronic Devices and Circuits Laboratory ....1
EET 2233 Electrical Machinery ..................................4
EET 3225 Special Electronic Devices ..........................4
EET 3267 Communications Systems ............................3
EET 3268 Communications Systems Laboratory ..............1
EET 3281 Electrical Proj Dev and Troubleshooting ..........3
EET 3353 Sensors, Data Acquisition and Control ..........4
EET 3373 Introduction to Programmable Controllers .......3
EET 4480 Senior Project .......................................6
EET 4480 Senior Project* .....................................4
Choose 7 credits from the following: .........................7
MAT 1115 Technical Mathematics I ..........................5
MAT 1125 Technical Mathematics II ..........................5
MAT 2215 Technical Mathematics III ..........................3
MAT 3225 Technical Mathematics IV ..........................3
PH 1100 Introductory Physics Lab I ............................1
RH 1110 College Physics I .....................................3
Science Elective ..................................................4

BACCALAUREATE DEGREE REQUIREMENTS 27
## Engineering Technology, BS

### Mechanical Engineering Technology Concentration

#### School of Technology

Any student interested in knowing why and how things work and applying that knowledge to solve real-life problems is a candidate for an Engineering Technology program. We offer a blend of application and theory that favors students that prefer to "learn by doing." Mechanical engineering technologists help create or develop power plants, automobiles, manufacturing processes, and countless other devices in many industries. The department offers specializations in three areas: thermal science, design, and manufacturing. Our year-long senior project sequence involves students in real-world problems, often collaborating with industry. The fluid power laboratory allows students to visualize the academic principles discussed in several courses by actually building and operating various hydraulic circuits. We also have a complete machine shop as well as CAD/CAM/ORE laboratories using both Windows NT and SunOS. The MET unit utilizes a facility in Calumet, which houses a dynamometer, where students study propulsion system analysis and driveline integration.

### Total Credits Required: 127

#### Major Requirements—87 credits

<table>
<thead>
<tr>
<th>Course Code</th>
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<th>Credits</th>
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<td>ENG 1102</td>
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<td>Introduction to Statistical Analysis</td>
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<tr>
<td>MET 2130</td>
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<tr>
<td>MET 2153</td>
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<td>MET 2242</td>
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<td>MET 3250</td>
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<td>MET 3361</td>
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<td>MET 3450</td>
<td>Machine Design II</td>
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<tr>
<td>MET 3650</td>
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### Concentration Requirements—12 credits

Choose 12 credits of technical electives from the following:

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<th>Course Title</th>
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<td>MET 4400</td>
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<td>Manufacturing Process</td>
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<tr>
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<tr>
<td>MET 4700</td>
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<td>3</td>
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### Free Electives—0 credits

#### General Education Requirements—28 credits

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### Concentration Requirements—12 credits

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### Free Electives—0 credits

#### General Education Requirements—28 credits

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</table>
Co-Curricular Activities—3 units
Currently only PE classes qualify; units are required for graduation, but are not included in the calculation of the GPA, or in the overall credits required for the degree.

Mechanical Engg Technology Model Schedule—example only; actual schedule may vary. Include 3 units of co-curricular activities.

<table>
<thead>
<tr>
<th>1st Year Fall</th>
<th>1st Year Spring</th>
<th>2nd Year Fall</th>
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<th>3rd Year Fall</th>
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<td>CH 1100</td>
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</table>

Total Credits Required: 127

Engineering, BS

The BS in Engineering (BSE) curriculum allows a student with career objectives that cannot be achieved through one of the other curricula to pursue a course of study tailored to match those specific objectives. The BSE degree prepares the student for lifelong learning in the form of graduate degrees, self-learning and/or taking additional course work or seminars beyond the degree.

MANUFACTURING CONCENTRATION

College of Engineering

This focus develops a system approach to problem solving, providing the student with an understanding of all the internal and external forces that can affect a manufacturing process/system. The curriculum is designed around a core engineering base with components in human relations, statistics, industrial engineering, total quality concepts, and business. The student has the opportunity to achieve specialized education in manufacturing, industrial design, or business areas.

Total Credits Required: 127

Major Requirements—58 credits

<table>
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<th>Course Code</th>
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<td>Calc I CR MA 1160 Calc with Technology I</td>
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<td>Calc II CR MA 2160 Calc with Technology II</td>
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<td>MEEM 2200</td>
<td>Thermodynamics</td>
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Concentration Requirements—38 credits

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<td>MA 3160</td>
<td>Multivariable Calculus with Technology</td>
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<td>Probability</td>
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<td>MEEM 2500</td>
<td>Integrated Design &amp; Manufacturing</td>
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<td>Adv Machining Processes, 4615 Metal Forming Processes, 4620 Metal Forming &amp; Cutting Mach, 4625 Precision Manuf &amp; Metrology, 4635 Design with Plastics, 4640 Micromachining Processes, 4650 Quality Engineering, 4660 Data-Based Modeling &amp; Control, 4655 Production Planning, 4665 Manuf System Simulation, 4675 Material Handling Plant Layout, 4685 Env Resp Design &amp; Manuf, 4705 Automation and Robotics, BA 4570 Employment Law, BA 4610 Project Management, MY 4130 Principles of Metal Casting, BE__</td>
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Free Electives—3 credits

General Education Requirements—28 credits

<table>
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<td>Perspectives on Inquiry</td>
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<tr>
<td>UN 1002</td>
<td>World Cultures</td>
<td>4</td>
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<tr>
<td>UN 2001</td>
<td>Revisions</td>
<td>3</td>
</tr>
<tr>
<td>UN 2002</td>
<td>Institutions</td>
<td>3</td>
</tr>
<tr>
<td>Note: Two semesters of a single modern language (6 cr) in addition to UN 1003 World Cultures Activities (1 cr) can substitute for UN 1002.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DISTRIBUTION COURSES</td>
<td></td>
<td>15</td>
</tr>
</tbody>
</table>

Students must take two courses each from two different lists, one that has World Cultures as a prerequisite and one that has Institutions as a prerequisite. The fifth course can come from any list. See the General Education section for specific lists and allowed courses. This program requires the following as a distribution course:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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</thead>
<tbody>
<tr>
<td>EC 3400</td>
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<td>3</td>
</tr>
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</table>

Science Min—Satisfied by major requirements above.

Co-Curricular Activities—3 units

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Manufacturing Model Schedule—example only; actual schedule may vary. Include 3 units of co-curricular activities.

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<tr>
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<td>PH 1200</td>
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1st Year Fall

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<td>ENG 1102</td>
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<td>MA 2150</td>
<td>Calc II CR MA 2160 Calc with Technology II</td>
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<td>Elem Diff Equat CR MA 3530 Intro to Diff Equat</td>
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### Engineering, BS

**MANUFACTURING—ENGINEERING ENTERPRISE CONCENTRATION**

**College of Engineering**

<table>
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<tbody>
<tr>
<td><strong>Major Requirements—52 credits</strong></td>
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<tr>
<td>CH 1100 Gen Chem OR CH 1110 Univ Chem</td>
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<td>MA 2150 Calc II OR MA 2160 Calc with Tech II</td>
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<td>MA 2230 Elementary Linear Algebra</td>
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<td>MEEM 2120 Statics Strength of Materials OR MA 2320 Elementary Linear Algebra</td>
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<td>MEEM 2500 Integrated Design &amp; Manufacturing</td>
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<td>MY 2100 Intro to Materials Science and Engineering</td>
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<td>PH 2200 Univ Physics II-Elc &amp; Magnetism</td>
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**Concentration Requirements—48 credits**

| BA 3690 Management Science | 3 |
| EC 3400 Economic Decision Analysis | 3 |
| ENG 2950 Engineering Enterprise Orientation | 3 |
| ENG 2960 Engineering Enterprise Project Work I | 3 |
| ENG 3960 Engineering Enterprise Project Work II | 3 |
| ENG 4950 Engineering Enterprise Project Work IV | 2 |
| ENG 4960 Engineering Enterprise Project Work V | 2 |
| MA 3160 Multivariable Calculus with Technology | 4 |
| MA 3720 Probability | 3 |
| MEEM 2500 Integrated Design & Manufacturing | 4 |
| MEEM 3501 Product Realization I | 3 |
| MEEM 3502 Product Realization II | 3 |
| MEEM 3503 Advanced Machining Processes | 3 |

**Technical Electives** — Choose 6 credits from process elective courses:

- MEEM 4610 Advanced Machining Processes
- MEEM 4615 Metal Forming Processes
- MEEM 4620 Metal Forming & Cutting Mach
- MEEM 4625 Precision Mach and Metrology
- MEEM 4635 Design with Plastics
- MEEM 4640 Micromanufacturing Processes

**Choose 6 credits from system elective courses:**

- MEEM 4650 Quality Engineering
- MEEM 4655 Production Planning
- MEEM 4660 Data Based Modeling & Control
- MEEM 4665 Manuf System Simulation
- MEEM 4765 Material Handling Plant Layout
- MEEM 4885 Environ Design & Manuf
- MEEM 5470 Employment Law
- MEEM 4610 Project Management

**Free Electives—0 credits**

**General Education Requirements—28 credits**

| UN 1001 Perspectives on Inquiry | 3 |
| UN 1002 World Cultures | 4 |
| UN 2001 Revisions | 3 |
| UN 2002 Institutions | 3 |

**Co-Curricular Activities—3 units**

- General Ed Distribution—Satisfied by major requirements above.
- Technical Electives—7 credits
- Note: Two semesters of a single modern language (6 cr) in addition to UN 1003 World Cultures Activities (1 cr) can substitute for UN 1002.

**Distribution courses**—15 credits

- Students must take two courses each from two different lists, one that has World Cultures as a prerequisite and one that has Institutions as a prerequisite. The fifth course can come from any list. See the General Education section for specific lists and allowed courses. This program requires the following in place of the fifth course:
  - ENG 2561 Teaming in the Engineering Enterprise
  - ENG 2562 Communication Contexts
  - ENG 3562 Communication Strategies

**Electives—Satisfied by major requirements above.**

**Engineering, BS**

**MANUFACTURING—DISTANCE CONCENTRATION**

**College of Engineering**

The distance education BSE degree focuses mainly on the mechanical and energy sciences with additional emphasis on mechanics, material sciences, electrical systems, and structures. These concentrations have been developed with and are offered to industrial partners, and relevant courses are provided to company employees through a variety of delivery systems, such as videotaped delay, Web-based instruction, and internet video streaming.
### Concentration Requirements—38 credits

<table>
<thead>
<tr>
<th>Course</th>
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<tbody>
<tr>
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<td>MEEM 3230 Heat Transfer</td>
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<tr>
<td>MEEM 3501 Product Realization I</td>
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<td>MEEM 3700 Mechanical Vibrations</td>
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<td>MEEM 4615D Metal Forming Processes</td>
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<td>MEEM 4700D Dynamic Systems and Controls</td>
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<td>MEEM 4900 Senior Design I</td>
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<tr>
<td>MEEM 4993D Design for Manufacturability</td>
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**Free Electives—0 credits**

### General Education Requirements—28 credits

<table>
<thead>
<tr>
<th>Course</th>
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<tbody>
<tr>
<td>MA 1150 Calc I OR MA 1160 Calc with Technology OR MA 2160 Calc with Tech I</td>
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<td>MA 2320 Elementary Linear Algebra</td>
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<td>MEEM 3210 Statics</td>
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<tr>
<td>MEEM 3230 Heat Transfer</td>
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<td>MEEM 3502 Product Realization II</td>
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<td>MEEM 4615D Metal Forming Processes</td>
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**SCI/ENG/PHYS Optimization**

- **3rd Year Fall**
  - EC 3400
  - EE 3010
  - MA 3520
  - MA 3710
  - MEEM 2200

**Total**

- **4th Year Fall**
  - EC 3400
  - EE 3010
  - MA 3520
  - MA 3710
  - MEEM 2200

**Total**

### Engineering, BS

#### MECHANICAL DESIGN—DISTANCE CONCENTRATION

**College of Engineering**

The distance education BSE degree focuses mainly on the mechanical and energy sciences with additional emphasis on mechanics, material sciences, electrical systems, and structures. These concentrations have been developed with and are offered to industrial partners, and relevant courses are provided to company employees through a variety of delivery systems, such as videotaped delay, Web-based instruction, and internet video streaming.

### Total Credits Required: 120

**Major Requirements—54 credits**

<table>
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<tr>
<th>Course</th>
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<tr>
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**Free Electives—0 credits**

### General Education Requirements—28 credits

**General Ed Distribution**

- **3rd Year Fall**
  - EC 3400
  - EE 3010
  - MA 3520
  - MA 3710
  - MEEM 2200

**Total**

- **4th Year Fall**
  - EC 3400
  - EE 3010
  - MA 3520
  - MA 3710
  - MEEM 2200

**Total**

### Notes

- Two semesters of a single modern language (6 cr) in addition to UN 1003 World Cultures Activities (1 cr) can substitute for UN 1002.
- Students must take two courses each from two different lists, one that has World Cultures as a prerequisite and one that has Institutions as a prerequisite. The fifth course can come from any list. See the General Education section for specific lists and allowed courses. This program requires the following as a distribution course:
  - EC 3400 Economic Decision Analysis

### Concentration Requirements—38 credits

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<tr>
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**Free Electives—0 credits**

### General Education Requirements—28 credits

**Core**

- **3rd Year Fall**
  - UN 1001 Perspectives on Inquiry
  - UN 1002 World Cultures
  - UN 2001 Revisions

- **4th Year Fall**
  - UN 1001 Perspectives on Inquiry
  - UN 1002 World Cultures

**Total**

- **3rd Year Fall**
  - UN 1001 Perspectives on Inquiry
  - UN 1002 World Cultures
  - UN 2001 Revisions

- **4th Year Fall**
  - UN 1001 Perspectives on Inquiry
  - UN 1002 World Cultures

**Total**

### Notes

- Currently only PE classes qualify; units are required for graduation, but are not included in the calculation of the GPA, or in the overall credits required for the degree.
- Manufacturing Distance Educ Model Schedule—example only; actual schedule may vary. Include 3 units of co-curricular activities.
- Note: Two semesters of a single modern language (6 cr) in addition to UN 1003 World Cultures Activities (1 cr) can substitute for UN 1002.
- Students must take two courses each from two different lists, one that has World Cultures as a prerequisite and one that has Institutions as a prerequisite. The fifth course can come from any list. See the General Education section for specific lists and allowed courses. This program requires the following as a distribution course:
  - EC 3400 Economic Decision Analysis

**Total Credits Required: 120**

- **Major Requirements—54 credits**
- **Free Electives—0 credits**
- **Total Credits Required: 120**
Environmental Engineering, BS

**College of Engineering**

Environmental engineers design, operate, and regulate systems that protect human health and the environment. Large corporations; state, federal, and local government; engineering consulting firms; and non-governmental organizations hire environmental engineers. Technical specialties of environmental engineers include processes for air, water, and soil treatment, and natural systems such as lakes and rivers. Job assignment will always include solving problems and could include using computers to evaluate treatment systems and movement of pollutants in the environment, working with the public, and collecting samples.

**Total Credits Required: 131**

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<td>BL 3310 Environmental Microbiology</td>
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<td>EC 3400 Economic Decision Analysis</td>
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**Co-Curricular Activities—3 units**

Currently only PE classes qualify; units are required for graduation, but are not included in the calculation of the GPA, or in the overall credits required for the degree.

**Mechanical Design Distance Educ Model Schedule—example only; actual schedule may vary. Include 3 units of co-curricular activities.**

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Environmental Engineering, BS
ENGINEERING ENTERPRISE CONCENTRATION

College of Engineering

Total Credits Required: 131

Major Requirements—67 credits

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<td>CE 3810 Soil Mechanics for Engineers</td>
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<td>CE 4501 Environmental Engg Chemical Processes</td>
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<td>CE 4503 Drinking Water Treatment and Distribution</td>
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Concentration Requirements—13 credits

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Approved elective modules: .5

BACCALAUREATE DEGREE REQUIREMENTS 33

for Manufacturing, 3970 Enterprise Spec Topics, 4951 Budgeting Entrepren Engg, 4952 Complex Comm Prac, 953 Writing Engg Societal Context, 4954 Global Competition, 4970 Enterprise Spec Topics

Free Electives—3 credits

General Education Requirements—28 credits

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<td>UN 2002 Institutions</td>
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DISTRIBUTION COURSES—15 units

Students must take two courses each from two different lists, one that has World Cultures as a prerequisite and one that has Institutions as a prerequisite. The fifth course can come from any list. See General Education section for specific lists and allowed courses. This program requires the following in place of the fifth course:

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<td>ENG 2962 Communication Strategies</td>
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SCIENCE/MATH—Satisfied by major requirements above.

Co-Curricular Activities—3 units

Currently only PE classes qualify; units are required for graduation, but are not included in the calculation of the GPA, or in the overall credits required for the degree.

Environmental Engineering Enterprise Model Schedule—example only; actual schedule may vary. Include 3 units of co-curricular activities.

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Forestry, BS
School of Forestry and Wood Products

The BS degree in Forestry is designed to educate students for scientific, technical, and management careers in forestry and renewable resources management. This degree program is accredited by the Society of American Foresters. The study emphases can be grouped into selected areas of concentration from which electives can be taken: ecosystem management—includes silviculture, watershed management, growth and yield modeling, and harvest scheduling; forest ecology—includes ecology, landscape ecology, soils, geology, pathology, entomology, and tree improvement; wildlife ecology and management—includes ecology, population dynamics and management approaches for mammals and birds.

Total Credits Required: 128

Major Requirements—87 credits

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Concentration Requirements—0 credits

Free Electives—13 credits

General Education Requirements—28 credits

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Note: Two semesters of a single modern language (6 cr) in addition to UN 1003 World Cultures Activities (1 cr) can substitute for UN 1002.

Total Credits Required: 138

Major Requirements—95 credits

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<tr>
<td>GE 3150</td>
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<tr>
<td>GE 3600</td>
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<tr>
<td>GE 3800</td>
<td>Earth Mechanics</td>
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<tr>
<td>GE 3850</td>
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<td>GE 3900</td>
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<tr>
<td>GE 3910</td>
<td>Field Geo w/ Engg Apps</td>
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</tr>
<tr>
<td>GE 4900</td>
<td>Geological Engg Design Proj I</td>
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<tr>
<td>GE 4910</td>
<td>Geological Engg Design Proj II</td>
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</tr>
<tr>
<td>MA 1150</td>
<td>Calc I OR MA 1160 Calc with Technology I</td>
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<tr>
<td>MA 2150</td>
<td>Calc II OR MA 2160 Calc with Technology II</td>
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<tr>
<td>MA 2310</td>
<td>Applied Linear Algebra Lab</td>
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<td>MA 2320</td>
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<td>MA 3160</td>
<td>Multivariable Calculus with Technology</td>
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<tr>
<td>MA 3520</td>
<td>Elementary Differential Equations</td>
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</table>

Geological Engineering, BS

College of Engineering

Geological Engineering is engineering applied to human problems that relate to earth systems. It is a broad interdisciplinary field with many specialty areas such as exploration and development of energy and mineral resources; mechanical properties and behavior of natural material in engineering applications; environmental site characterization and planning; natural and human-induced hazard investigation and planning; and hydrogeology and groundwater engineering.

Total Credits Required: 138

Major Requirements—95 credits

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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<td>Soil Mechanics for Engineers</td>
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<td>CH 1100</td>
<td>General Chemistry</td>
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<td>EN 1101</td>
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<tr>
<td>GE 2300</td>
<td>Earth Mat I: Mineralogy</td>
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<td>GE 2310</td>
<td>Earth Mat II: Rock &amp; Min Res</td>
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<tr>
<td>GE 2400</td>
<td>Intro to Appl &amp; Env Geophysics</td>
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<td>GE 3000</td>
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<td>3</td>
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<td>GE 3100</td>
<td>Depositional Systems</td>
<td>4</td>
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<tr>
<td>GE 3150</td>
<td>Petroleum Geology</td>
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<td>Geological Engg Design Proj I</td>
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<td>Geological Engg Design Proj II</td>
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<td>Calc II OR MA 2160 Calc with Technology II</td>
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<tr>
<td>MA 3520</td>
<td>Elementary Differential Equations</td>
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</table>
### Geological Engineering, BS

**Engineering Enterprise Concentration**

#### College of Engineering

**Total Credits Required:** 138

**Major Requirements:** 94 credits

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
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<tbody>
<tr>
<td>CE 3810 Soil Mechanics for Engineers</td>
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<tr>
<td>CH 1100 General Chemistry</td>
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<td>EN 1101 Fundamentals of Engineering I</td>
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<td>GE 2200 Earth Systems</td>
<td>.4</td>
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<td>GE 2300 Earth Materials I: Mineralogy</td>
<td>.4</td>
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<tr>
<td>GE 2310 Earth Materials II: Rocks &amp; Mineral Res</td>
<td>.3</td>
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<tr>
<td>GE 2400 Intro to Applied and Environ Geophysics</td>
<td>.4</td>
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<td>GE 3000 Structural Geology</td>
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<td>GE 3200 Geochemistry</td>
<td>.3</td>
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<td>GE 3600 Sampling and Data Analysis</td>
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<td>GE 4200 Geohydrology</td>
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<td>GE 3900 Field Geophysics</td>
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<tr>
<td>GE 3910 Field Geology with Engineering Applications</td>
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<td>MA 1150 Calc I CR MA 3160 Calc with Tech</td>
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<td>MA 2150 Calc II CR MA 2160 Calc with Technology II</td>
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<td>MA 2310 Applied Linear Algebra Lab</td>
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<td>MA 2220 Elementary Linear Algebra</td>
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<tr>
<td>MA 3150 Multivar Calc CR MA 3160 Multivar Calc with Tech</td>
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<td>CE 3810 Engineering Enterprise Orientation</td>
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<td>ENG 3401 Economic Decision Analysis I</td>
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<td>ENG 3403 Economic Decision Analysis III</td>
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<td>Concept Design Problem Solving, 3560 Industry Health and Safety, 3961 Engg Ent Str Based Leadership, 3964 Project Management, 3965 Material Flow in Society, 3966 Design for Manufacturing, 3970 Enterprise Special Topics, 4951 Budgeting Entrepreneur, 4952 Complex Comm Practises, 4953 Writing Engg Societal Context, 4954 Global Competition, 4970 Enterprise Special Topics</td>
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</table>

**Co-Curricular Activities—3 units**

Currently only PC classes qualify; units are required for graduation, but are not included in the calculation of the GPA, or in the overall credits required for the degree.

**Geological Engineering Model Schedule—example only; actual schedule may vary. Include 3 units of co-curricular activities.**

<table>
<thead>
<tr>
<th>1st Year Fall</th>
<th>2nd Year Fall</th>
<th>3rd Year Fall</th>
<th>4th Year Fall</th>
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<tbody>
<tr>
<td>ENS 1101</td>
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<td>CH 1100</td>
<td>MA 3160</td>
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<tr>
<td>MA 1150 CR 1160</td>
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<td>PH 1200</td>
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<td>Technical Elective*</td>
</tr>
<tr>
<td>MA 1150 CR 1160</td>
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<td>GE 3200</td>
<td>Technical Elective*</td>
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<td>MA 1150 CR 1160</td>
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<td>Technical Elective*</td>
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<td>MA 3520</td>
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<td>Total</td>
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<tr>
<td>MA 1150 CR 1160</td>
<td>MA 3520</td>
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<td>18</td>
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</table>

**Free Electives—3 credits**

### General Education Requirements—28 credits

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
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<tbody>
<tr>
<td>CR 1001 Perspectives on Inquiry</td>
<td>.3</td>
</tr>
<tr>
<td>UN 1002 World Cultures</td>
<td>.4</td>
</tr>
<tr>
<td>UN 2001 Revisions</td>
<td>.3</td>
</tr>
<tr>
<td>UN 2002 Institutions</td>
<td>.3</td>
</tr>
</tbody>
</table>

Note: Two semesters of a single modern language (6 cr) in addition to UN 1003 World Cultures Activities (1 cr) can substitute for UN 1002.

**DISTRIBUTION COURSES**

Students must take two courses each from two different lists, one that has World Cultures as a prerequisite and one that has Institutions as a prerequisite. The fifth course can come from any list. See the General Education section for specific lists and allowed courses. This program requires the following as a distribution course:

**Co-Curricular Activities—3 units**

Currently only PC classes qualify; units are required for graduation, but are not included in the calculation of the GPA, or in the overall credits required for the degree.

**Geological Engineering Model Schedule—example only; actual schedule may vary. Include 3 units of co-curricular activities.**

<table>
<thead>
<tr>
<th>1st Year Fall</th>
<th>2nd Year Fall</th>
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</tr>
</thead>
<tbody>
<tr>
<td>ENS 1101</td>
<td>GE 2200</td>
<td>GE 3200</td>
<td>GE 4900</td>
</tr>
<tr>
<td>CH 1100</td>
<td>MA 3160</td>
<td>MA 3920</td>
<td>GE 4910</td>
</tr>
<tr>
<td>MA 1150 CR 1160</td>
<td>PH 2100</td>
<td>GE 3910</td>
<td>Technical Elective*</td>
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<tr>
<td>MA 1150 CR 1160</td>
<td>PH 1200</td>
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<td>MA 3920</td>
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<td>Total</td>
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<tr>
<td>MA 1150 CR 1160</td>
<td>MA 3520</td>
<td>15</td>
<td>18</td>
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**Free Electives—3 credits**

### General Education Requirements—28 credits

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
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<tbody>
<tr>
<td>UN 1001 Perspectives on Inquiry</td>
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</tr>
<tr>
<td>UN 1002 World Cultures</td>
<td>.4</td>
</tr>
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<td>UN 2001 Revisions</td>
<td>.3</td>
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<tr>
<td>UN 2002 Institutions</td>
<td>.3</td>
</tr>
</tbody>
</table>

Note: Two semesters of a single modern language (6 cr) in addition to UN 1003 World Cultures Activities (1 cr) can substitute for UN 1002.

**DISTRIBUTION COURSES**

Students must take two courses each from two different lists, one that has World Cultures as a prerequisite and one that has Institutions as a prerequisite. The fifth course can come from any list. See the General Education section for specific lists and allowed courses. This program requires the following as a distribution course:

**Technical Elective**
Geology, BS

College of Engineering

Geology is the study of the earth, earth materials, and earth systems. It is a physical and natural science and is involved in development of natural resources such as oil, natural gas, minerals, and ground water, protection of the environment, remote sensing and land use planning, and natural and human-made hazard investigation.

Total Credits Required: 138

<table>
<thead>
<tr>
<th>Major Requirements—78 credits</th>
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<tbody>
<tr>
<td>CH 1110 University Chemistry I</td>
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<td>CH 1111 University Chemistry II</td>
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<td>CH 1120 University Chemistry II</td>
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<td>CH 1140 Fundamentals of Engineering I</td>
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<td>GE 2200 Earth Systems</td>
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<td>GE 2300 Earth Minerals</td>
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<tr>
<td>GE 2310 Earth Materials II: Rocks &amp; Minerals</td>
</tr>
<tr>
<td>GE 2400 Intro to Appl Environ Geophysics</td>
</tr>
<tr>
<td>GE 3000 Structural Geology</td>
</tr>
<tr>
<td>GE 3100 Depositional Systems</td>
</tr>
<tr>
<td>GE 3150 Petroleum Geology</td>
</tr>
<tr>
<td>GE 3200 Geochemistry</td>
</tr>
<tr>
<td>GE 3600 Sampling and Data Analysis</td>
</tr>
</tbody>
</table>

* See the department advising coordinator for the courses that will fulfill these requirements.

GE 3850 Geohydrology | 3 |
GE 3900 Field Geophysics | 5 |
GE 3910 Field Geology with Engg Applications | 4 |
MA 1150 Calc I CR MA 1160 Calc with Technology I | 4 |
MA 2150 Calc II CR MA 2160 Calc with Technology II | 4 |
MA 2310 Applied Linear Algebra Lab | 1 |
MA 2321 Elementary Linear Algebra | 2 |
MA 3150 Multivariable Calc CR MA 3160 Multivariable Calc with Tech | 4 |
PH 1100 Introductory Physics Lab I | 1 |
PH 1200 Introductory Physics Lab II | 1 |
PH 2100 Univ Physics I-Mechanics | 3 |
PH 2200 Univ Physics II-Elec & Magnetism | 3 |

Concentration Requirements—25 credits

Advanced Geophysics Elective* | 5 |
Geo-Approved Electives* | 22 |

Free Electives—7 credits

General Education Requirements—28 credits

Note: Two semesters of a single modern language (6 cr) in addition to UN 1003 World Cultures Activities (1 cr) can substitute for UN 1002.

Co-Curricular Activities—3 units

Currently only PE classes qualify; units are required for graduation, but are not included in the calculation of the GPA or in the overall credits required for the degree.

Geology Model Schedule—example only, actual schedule may vary. Include 3 units of co-curricular activities.

1st Year Fall
CH 1140 University Chemistry | 4 |
CH 1141 University Chemistry I | 4 |
MA 1160 CR 1160 Calc with Technology I | 4 |
PH 1100 Introductory Physics Lab I | 1 |
UN 1001 Perspectives on Inquiry | 3 |
Total | 17–18 |

1st Year Spring
CH 1142 University Chemistry | 4 |
CH 1141 University Chemistry I | 4 |
MA 1170 CR 1170 Calc with Technology II | 4 |
PH 1100 Introductory Physics Lab I | 1 |
UN 1001 Perspectives on Inquiry | 3 |
Total | 17–18 |

2nd Year Fall
CH 1143 University Chemistry | 4 |
CH 1141 University Chemistry I | 4 |
MA 1180 CR 1180 Calc with Technology III | 4 |
PH 1100 Introductory Physics Lab II | 1 |
UN 1001 Perspectives on Inquiry | 3 |
Total | 17–18 |

2nd Year Spring
CH 1144 University Chemistry | 4 |
CH 1141 University Chemistry I | 4 |
MA 1190 CR 1190 Calc with Technology IV | 4 |
PH 1100 Introductory Physics Lab III | 1 |
UN 1001 Perspectives on Inquiry | 3 |
Total | 17–18 |

3rd Year Fall
CH 1145 University Chemistry | 4 |
CH 1141 University Chemistry I | 4 |
MA 1200 CR 1200 Calc with Technology V | 4 |
PH 1100 Introductory Physics Lab IV | 1 |
UN 1001 Perspectives on Inquiry | 3 |
Total | 17–18 |

3rd Year Spring
CH 1146 University Chemistry | 4 |
CH 1141 University Chemistry I | 4 |
MA 1210 CR 1210 Calc with Technology VI | 4 |
PH 1100 Introductory Physics Lab V | 1 |
UN 1001 Perspectives on Inquiry | 3 |
Total | 17–18 |

4th Year Fall
CH 1147 University Chemistry | 4 |
CH 1141 University Chemistry I | 4 |
MA 1220 CR 1220 Calc with Technology VII | 4 |
PH 1100 Introductory Physics Lab VI | 1 |
UN 1001 Perspectives on Inquiry | 3 |
Total | 17–18 |

4th Year Spring
CH 1148 University Chemistry | 4 |
CH 1141 University Chemistry I | 4 |
MA 1230 CR 1230 Calc with Technology VIII | 4 |
PH 1100 Introductory Physics Lab VII | 1 |
UN 1001 Perspectives on Inquiry | 3 |
Total | 17–18 |

5th Year Fall
CH 1149 University Chemistry | 4 |
CH 1141 University Chemistry I | 4 |
MA 1240 CR 1240 Calc with Technology IX | 4 |
PH 1100 Introductory Physics Lab VIII | 1 |
UN 1001 Perspectives on Inquiry | 3 |
Total | 17–18 |

5th Year Spring
CH 1150 University Chemistry | 4 |
CH 1141 University Chemistry I | 4 |
MA 1250 CR 1250 Calc with Technology X | 4 |
PH 1100 Introductory Physics Lab IX | 1 |
UN 1001 Perspectives on Inquiry | 3 |
Total | 17–18 |

6th Year Fall
CH 1151 University Chemistry | 4 |
CH 1141 University Chemistry I | 4 |
MA 1260 CR 1260 Calc with Technology XI | 4 |
PH 1100 Introductory Physics Lab X | 1 |
UN 1001 Perspectives on Inquiry | 3 |
Total | 17–18 |

6th Year Spring
CH 1152 University Chemistry | 4 |
CH 1141 University Chemistry I | 4 |
MA 1270 CR 1270 Calc with Technology XII | 4 |
PH 1100 Introductory Physics Lab XI | 1 |
UN 1001 Perspectives on Inquiry | 3 |
Total | 17–18 |

* See the department advising coordinator for the courses that will fulfill these requirements.
Geology, BS
SECONDARY EDUCATION—EARTH SCIENCE CONCENTRATION

College of Engineering

Geology with Earth Science Education concentration includes a teaching major in earth science composed of geology, oceanography, meteorology, and astronomy, and teaching minor such as general science, mathematics, or computer science. The earth science concentration prepares students for the teaching profession at the middle to high school level.

Total Credits Required: 138
Major Requirements—73 credits
BL 1040 Principles of Biology ................................................. 4
CH 1100 General Chemistry ................................................... 4
ENG 1101 Fundamentals of Engineering I .............................. 3
GE 2200 Earth Systems ....................................................... 4
GE 2300 Earth Materials I: Mineralogy ................................... 3
GE 2310 Earth Materials II: Rocks & Mineral Resources ........... 3
GE 2400 Intro to Applied & Environ Geophysics .................... 4
GE 2640 Introduction to Meteorology .................................... 3
GE 3000 Structural Geology .................................................. 3
GE 3300 Introduction to Oceanography ................................. 3
GE 3320 Earth History and Paleoclimatology ....................... 3
GE 3600 Sampling and Data Analysis .................................... 3
GE 3900 Reld Geophysic ..................................................... 5
GE 3910 Reld Geophysic with Eng Applicat ........................... 5
GE 4000 Earth Science Teaching Experience ......................... 1
MA 1150 Calc I OR MA 1160 Calc with Technology I ............. 4
MA 2150 Calc II OR MA 2160 Calc with Technology II ............ 4
MA 2310 Applied Linear Algebra Lab ..................................... 1
MA 3230 Elementary Linear Algebra .................................... 2
PH 1100 Introductory Physics Lab I ..................................... 1
PH 1200 Introductory Physics Lab II .................................... 1
PH 1600 Introductory Astronomy .......................................... 2
PH 1610 Introductory Astronomy Lab ................................... 1
PH 2100 Univ Physics I-Mechanics ...................................... 3
PH 2200 Univ Physics II-Elec & Magnetism ........................... 3

Concentration Requirements—34 credits
Geo-Approved Electives* ..................................................... 6
ED 2100 Instructional Technology ......................................... 3
HU 4150 Literacy in the Content Areas ................................. 12
Courses in each block must be taken concurrently.

EDUCATION EARLY BLOCK
ED 3110 Psychological Foundations of Learning ..................... 2
ED 3210 Foundations of Education ....................................... 2
ED 3310 Seminar in Education ............................................. 2
ED 3410 Clinical Experience ................................................ 1

EDUCATION LATE BLOCK
ED 4190 Methods of Teaching Science, Math, and CS ............ 4
ED 4910 Directed Teaching .................................................. 12

Free Electives—3 credits

Total .......................... 16

Geology Secondary Educ Model Schedule—example only; actual schedule may vary. Include 3 units of co-curricular activities.

1st Year Fall
ED 1101 ................................................................. 4
GE 2300 ................................................................. 4
MA 1150 OR 1160 ........................................................... 4
PH 1100 ................................................................. 1
UN 1001 ................................................................. 3
Total .................................................. 15

2nd Year Fall
CH 1100 ................................................................. 4
PH 1200 ................................................................. 1
PH 2100 ................................................................. 1
UN 1002 ................................................................. 4
Total .................................................. 15

2nd Year Spring
GE 3320 ................................................................. 3
MA 2150 OR 2160 ........................................................... 4
PH 1200 ................................................................. 1
PH 2100 ................................................................. 1
UN 2002 ................................................................. 3
Total .................................................. 16

2nd Year Summer
GE 3900 ................................................................. 5

3rd Year Fall
General Ed Distribution .................................................... 3

3rd Year Spring
General Ed Distribution .................................................... 3

3rd Year Fall
General Ed Distribution .................................................... 3

4th Year Fall
GE 2310 ................................................................. 3
GE 2400 ................................................................. 3
GE 3000 ................................................................. 3
PH 1600 ................................................................. 2
PSY 2000 ................................................................. 3
UN 2002 ................................................................. 3
Free Elective .............................................................. 3
Total .................................................. 16

4th Year Spring
ED 4910 ................................................................. 12

Total .......................... 16

* See the department advising coordinator for the courses that will fulfill these requirements.

Applied Geophysics, BS
College of Engineering

Geophysics applies the principles of physics in the study of the Earth to discover what is inside. Applied geophysicists use measurements made on the Earth's surface that are controlled by lateral and vertical variations in physical properties in the subsurface (i.e., density, magnetic susceptibility, electrical conductivity, elastic moduli, etc.) to explore for oil, natural gas, and minerals and in the construction of dams, roads, landfill, buildings, and waste repositories.

Total Credits Required: 138
Major Requirements—90 credits
CH 1100 General Chemistry ................................................ 4
CS 1010 Intro to Programming for Engg & Appl Sci ............... 3
ENG 1101 Fundamentals of Engineering I ............................ 3
GE 2200 Earth Systems .................................................... 4
GE 2300 Earth Materials I: Mineralogy ............................... 4
GE 2310 Earth Materials II: Rocks & Mineral Resources ....... 4
GE 2400 Intro to Appl & Environ Geophysics ....................... 4
GE 3000 Structural Geology .............................................. 3
GE 3150 Petroleum Geology ............................................. 3
GE 3320 Earth History and Paleoclimatology ....................... 3
GE 3900 Field Geophysical ............................................... 5
GE 3910 Field Geophysic w/ Engg Applications ................... 5
GE 4500 Plate Tectons & Global Geophysics ....................... 3
# Baccalaureate Degree Requirements

**MA 1150** Calc I OR MA 1160 Calc w/ Technology I ........................................... 4  
**MA 2150** Calc II OR MA 2160 Calc w/ Technology II ........................................... 4  
**MA 2310** Applied Linear Algebra Lab ................................................................. 1  
**MA 2320** Elementary Linear Algebra ................................................................. 2  
**MA 3150** Multivar Calc OR MA 3160 Multivar Calc w/ Tech .................................... 4  
**MA 3510** Applied Differential Equations Lab ...................................................... 1  
**MA 3530** Intro to Differential Equations ............................................................ 3  
**MA 4210** Applied Wavelet Analysis ....................................................................... 3  
**PH 1100** Introductory Physics Lab I ....................................................................... 1  
**PH 1200** Introductory Physics Lab II ....................................................................... 1  
**PH 2100** Univ Physics I-Elec & Magnetism ............................................................ 3  
**PH 2230** Electronics for Scientists ...................................................................... 4  
**PH 2300** Univ Physics III-Radiants & Thermodynamics ......................................... 2  
**PH 2400** Univ Physics IV-Waves & Modern Physics ................................................ 2  
**PH 4380** Computers in the Physics Lab ................................................................. 2  

### Concentration Requirements—15 credits
- Advanced Geophysics Electives* ........................................................................... 12  
- Geo-Approved Elective* .................................................................................... 3  

### Free Electives—5 credits

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Core</td>
<td>13</td>
</tr>
<tr>
<td><strong>UN 1001</strong> Perspectives on Inquiry</td>
<td>3</td>
</tr>
<tr>
<td><strong>UN 1002</strong> World Cultures</td>
<td>4</td>
</tr>
<tr>
<td><strong>UN 2001</strong> Revisions</td>
<td>3</td>
</tr>
<tr>
<td><strong>UN 2002</strong> Institutions</td>
<td>3</td>
</tr>
</tbody>
</table>

Note: Two semesters of a single modern language (6 cr) in addition to UN 1003 World Cultures Activities (1 cr) can substitute for UN 1002.

### Distribution Courses—15 credits
- Students must take two courses each from two different lists, one that has World Cultures as a prerequisite and one that has Institutions as a prerequisite. The fifth course can come from any list. See the General Education section for specific lists and allowed courses. This program requires the following as a distribution course:
- **EC 3400** Economic Decision Analysis .................................................... 3

### Science/Math—Satisfactory by major requirements above.

### Co-Curricular Activities—3 units
- Currently only PE classes qualify; units are required for graduation, but are not included in the calculation of the GPA, or in the overall credits required for the degree.

### Applied Geophysics Model Schedule—example only; actual schedule may vary. Include 3 units of co-curricular activities.

<table>
<thead>
<tr>
<th>1st Year Fall</th>
<th>2nd Year Spring</th>
<th>3rd Year Summer</th>
<th>4th Year Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENG 1101</td>
<td>CS 1010</td>
<td>GE 3910</td>
<td>GE 3910</td>
</tr>
<tr>
<td>GE 2200</td>
<td>GE 2310</td>
<td>GE 3900</td>
<td>General Ed Distribution</td>
</tr>
<tr>
<td>MA 1150 OR 1160</td>
<td>GE 2400</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PH 1100</td>
<td>PH 2300</td>
<td></td>
<td></td>
</tr>
<tr>
<td>UN 1001</td>
<td>UN 2002</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>Total</strong></td>
<td><strong>Total</strong></td>
<td><strong>Total</strong></td>
</tr>
</tbody>
</table>

### 2nd Year Fall

<table>
<thead>
<tr>
<th>2nd Year Spring</th>
<th>3rd Year Fall</th>
<th>3rd Year Spring</th>
<th>4th Year Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>GE 3320</td>
<td>GE 3000</td>
<td>GE 3400</td>
<td>GE 3910</td>
</tr>
<tr>
<td>MA 2150 OR 2160</td>
<td>GE 3100</td>
<td>MA 3510</td>
<td>General Ed Distribution</td>
</tr>
<tr>
<td>PH 1200</td>
<td>MA 3510</td>
<td>PH 2230</td>
<td></td>
</tr>
<tr>
<td>UN 1002</td>
<td>MA 3530</td>
<td>Adv Geophysics Electives*</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>Total</strong></td>
<td><strong>Total</strong></td>
<td><strong>Total</strong></td>
</tr>
</tbody>
</table>

### Concentration Requirements—21 credits

- Complete 21 credits by choosing from the following:
  - Create, in consultation with advisor and with advisor’s permission, a concentration (21 cr), which is any collection of courses that can be shown to contribute to the student’s expertise in one area. Choose courses from more than one department and may include humanities courses.
  - Earn a Certificate in Modern Language and Area Study.
  - Take a minor and supplement it with an extra course to add up to 22 credits. The minor must include a minimum of 18 credits and must be from a field outside English, but it may be one offered by the humanities department. The minor alone will not meet this requirement.
  - Earn a Certificate in Media or in Writing, or both. These certificates require 21 cr, but 6 cr from each of these certificates may count toward the major requirements for this degree.

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### Liberal Arts, BA

**ENGLISH CONCENTRATION**  
*College of Sciences and Arts*

**Total Credits Required: 128**

### Major Requirements—76 credits

- **FA 2050** Speech Comm OR HU 2830 Intro to Speech Comm .................................. 3
- **HU 4071** Liberal Arts Capstone Project ..................................................... 3

### American Literature—12 credits

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>HUM 2501</strong> Amer Experience in Lit I, 2502 Amer Experience in Lit II, 3510 The American Novel, 3541 Major American Authors, 4542 Topics in American Literature</td>
<td></td>
</tr>
</tbody>
</table>

### British Literature—12 credits

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>HUM 2536</strong> British Experience in Lit I, 2539 British Experience in Lit II, 3501 Medieval Literature, 3512 Shakespeare I, 3513 Shakespeare II, 3540 Major British Authors, 3551 Renaissance Literature, 3552 Restoration and 18th Cent Lit, 3553 19th-Century British Lit, 3554 Contemporary British Authors, 3555 20th-Century British Lit</td>
<td></td>
</tr>
</tbody>
</table>

### World Literature—9 credits

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>HUM 3502</strong> World Mythologies, 3504 Novels from World Lit, 3251 Mod Masters, 2322 Lit in Trans, 2411 Mod Lang Sem I-Fr, 2412 Mod Lang Sem II-Fr, 2413 Mod Lang Sem III-Fr, 2421 Mod Lang Sem I-Ger, 2422 Mod Lang Sem II-Ger, 2423 Mod Lang Sem III-Ger, 2431 Mod Lang Sem I-Span, 2432 Mod Lang Sem II-Span, 2433 Mod Lang Sem III-Span, 4545 Topics in World Lit</td>
<td></td>
</tr>
</tbody>
</table>

### Fiction, Linguistics, or Communication—9 credits

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>HU 2130</strong> Intro to Phet, 2820 Comm &amp; Qlt, 2910 Lang &amp; Mind, 2922 Lang &amp; Soc, 3130 Rhet Theory &amp; Criticism, 3150 Reading &amp; Writing, 3151 Rhet of Everyday Texts, 3820 Interpersonal Comm, 3840 Organ Comm, 3850 Qlt Studies, 3860 Popular Qlt, 3910 Lang in the World, 3920 Lang &amp; Tech, 3930 Lang &amp; Educ, 4130 Spec Topics in Phet/Comp, 4150 Lit in the Content Areas, 4820 Modes of Comm, 4830 Phil of Comm, 4840 International Qlt, 4890 Topics in Comm</td>
<td></td>
</tr>
</tbody>
</table>

### Fine Arts or Upper-Level Modern Language—6 credits

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>HU 2110</strong> Creative Writing, 3120 Tech &amp; Sci Comm, 3621 Intro to Journalism, 3629 Practical Writing, 4110 Adv Creative Writing, 5090 Writing Literary Nonfiction</td>
<td></td>
</tr>
</tbody>
</table>

### Science and Mathematics—16 credits

- One (3 cr) lab science course, one (3 cr) math course, and 10 additional credits in science, math, or computer science.

### Concentration Requirements—21 credits

Complete 21 credits by choosing from the following:
- Create, in consultation with advisor and with advisor’s permission, a concentration (21 cr), which is any collection of courses that can be shown to contribute to the student’s expertise in one area. Choose courses from more than one department and may include humanities courses.
- Earn a Certificate in Modern Language and Area Study.
- Take a minor and supplement it with an extra course to add up to 22 credits. The minor must include a minimum of 18 credits and must be from a field outside English, but it may be one offered by the humanities department. The minor alone will not meet this requirement.
- Earn a Certificate in Media or in Writing, or both. These certificates require 21 cr, but 6 cr from each of these certificates may count toward the major requirements for this degree.
### Liberal Arts, BA

#### SECONDARY EDUCATION—ENGLISH CONCENTRATION

**College of Sciences and Arts**

**Total Credits Required:** 137–141  
**Major Requirements—61 credits**
- At least 15 credits must be at the 3000–4000 level.
- HU 2520 Cultural Diversity in American Literature 3  
- HU 2548 Adolescent Literature 3  
- HU 3512 Shakespeare I 3  
- HU 3513 Shakespeare II 3  
- HU 3540 Major British Authors 3  
- HU 3551 Renaissance Lit 3  
- HU 3552 Restoration & 18th Century Lit 3  
- HU 3553 19th Century Brit Lit 3  
- HU 3554 Contemp Brit Authors 3  
- PSY 2000 Principles of Psychology 3

**Concentration Requirements—48–52 credits**
- ED 2100 Instructional Technology 2  
- ED 4910 Directed Teaching 12  
- EDUCATION LATE BLOCK  
  - ED 4910 Directed Teaching 12  
  - Teaching Minor 20–24  
  - Choose from biology, chemistry, computer science, earth science, general science, mathematics, physical science, or social studies

**DISTRIBUTION COURSES**
- HU 2130 Intro to Rhetoric 3  
- HU 2501 Amer Experience in Lit I 3  
- HU 2502 Amer Experience in Lit II 3  
- HU 2538 Brit Experience in Lit I 3  
- HU 2539 Brit Experience in Lit II 3  
- HU 2547 Film or Applied Media 3  
- HU 2644 Comp Applications in Comm 3  
- PSY 2040 Social Psychology 3  
- SCIENCE/MATH—Satisfied by major requirements above.

**Free Electives—0 credits**

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### Baccalaureate Degree Requirements

**General Education Requirements—31 credits**
- Economics I 3  
- Economics II 3  
- American Lit Elective 3  
- Concentration Elective 3  
- Concentration Elective 3  
- Concentration Elective 3

**DISTRIBUTION COURSES**
- HU 2161 American Lit Elective 3  
- Concentration Elective 3  
- Concentration Elective 3  
- Concentration Elective 3  
- Concentration Elective 3  
- General Ed Distribution 3  
- General Ed Distribution 3  
- World Lit Elective 3  
- World Lit Elective 3  
- Concentration Elective 3  
- Concentration Elective 3

**General Education Requirements—28 credits**
- UN 1001 Perspectives on Inquiry 3  
- UN 1002 World Cultures 3  
- UN 2001 Revisions 3  
- UN 2002 Institutions 3  
- World Cultures as a prerequisite and one that has Institutions as a prerequisite. The fifth course can come from any list. See the General Education section for specific lists and allowed courses. This program requires the following as a distribution course: PSY 2000 Principles of Psychology 3

**Free Electives—0 credits**  
**Concentration Requirements—48–52 credits**
- ED 2100 Instructional Technology 2  
- ED 4910 Directed Teaching 12  
- EDUCATION LATE BLOCK  
  - ED 4910 Directed Teaching 12  
  - Teaching Minor 20–24  
  - Choose from biology, chemistry, computer science, earth science, general science, mathematics, physical science, or social studies

**DISTRIBUTION COURSES**
- HU 2130 Intro to Rhetoric 3  
- HU 2501 Amer Experience in Lit I 3  
- HU 2502 Amer Experience in Lit II 3  
- HU 2538 Brit Experience in Lit I 3  
- HU 2539 Brit Experience in Lit II 3  
- HU 2547 Film or Applied Media 3  
- HU 2644 Comp Applications in Comm 3  
- PSY 2040 Social Psychology 3  
- SCIENCE/MATH—Satisfied by major requirements above.

**Free Electives—0 credits**
English Secondary Educ Model Schedule—example only; actual schedule may vary. Include 3 units of co-curricular activities.

1st Year Fall
- HU 2520 ........................................... 3
- PSY 2000 ........................................... 3
- UN 1001 ........................................... 3
- Math Requirement ................................ 3
- Science Lab Requirement .......................... 4
- Total ............................................. 16

1st Year Spring
- HU 2110 CR 3120 CR 3621 ......................... 3
- UN 1002 ........................................... 4
- Math Requirement ................................ 3
- Minor ............................................. 3
- Science Requirement ............................... 3
- Total ............................................. 16

2nd Year Fall
- HU 2644 ........................................... 3
- HU 2910 ........................................... 3
- HU Elective-Br lit ................................... 3
- UN 2001 ........................................... 3
- CS Requirement ................................... 3
- Minor ............................................. 3
- Total ............................................. 18

2nd Year Spring
- HU 2130 CR 3150 CR 3151 ......................... 3
- HU 3605 ........................................... 3
- HU Elective-Brit Lit ................................ 3
- UN 2002 ........................................... 3
- Minor ............................................. 3
- Total ............................................. 15

3rd Year Fall
- General Ed Distribution ............................ 3
- ED 3110 ........................................... 2
- ED 3210 ........................................... 2
- ED 3310 ........................................... 1
- ED 3410 ........................................... 1
- HU Elective-Am Lit ................................ 3
- Minor ............................................. 3
- Minor ............................................. 3
- Total ............................................. 18

3rd Year Spring
- General Ed Distribution ............................ 3
- ED 2100 ........................................... 2
- HU 2324/2645/3324/3642 ......................... 3
- Minor ............................................. 3
- Minor ............................................. 3
- Total ............................................. 14

4th Year Fall
- General Ed Distribution ............................ 3
- HU 2548 ........................................... 3
- HU 4150 ........................................... 4
- HU Elective-World Lit .............................. 3
- Minor ............................................. 3
- Total ............................................. 16

4th Year Spring
- ED 4910 ........................................... 12
- HU 4140 ........................................... 4
- Total ............................................. 16

General Education Requirements—28 credits
- Core ............................................. 13
- UN 1001 Perspectives on Inquiry ............... 3
- UN 1002 World Cultures ........................... 4
- UN 2001 Revisions ................................ 3
- UN 2002 Institutions ............................... 3
- Note: Two semesters of a single modern language (6 cr) in addition to UN 1003 World Cultures Activities (1 cr) can substitute for UN 1002.

DISTRIBUTION COURSES
- Students must take two courses each from two different lists, one that has World Cultures as a prerequisite and one that has Institutions as a prerequisite. The fifth course can come from any list. See the General Education section for specific lists and allowed courses. This program requires the following as a distribution course:
  - EC 2000 Principles of Economics ............... 3
- SCIENCE/MATH—Satisfied by major requirements above.

Co-Curricular Activities—3 units
- Currently only PE classes qualify; units are required for graduation, but are not included in the calculation of the GPA, or in the overall credits required for the degree.

History Model Schedule—example only; actual schedule may vary. Include 3 units of co-curricular activities.

College of Sciences and Arts

Liberal Arts, BA

History Concentration

College of Sciences and Arts

Total Credits Required: 124

Major Requirements—45 credits

SS 1001 Orientation to the Social Sciences .................. 1
SS 2100 World Peoples & Environments ....................... 3
SS 2200 Prehistory and Archaeology ......................... 3
SS 2500 The American Experience .......................... 3
SS 2550 Themes in Western Civilization .................... 3
SS 2600 American Government & Politics ................... 3
SS 4910 Senior Orientation and Assessment ................. 1
American History .................................... 3
SS 2200 Prehistory and Archaeology, 3100 Developing Societies, 3810 Culture, Science & Technology, 3890 Industry & the World Economy, 3910 Histories and Cultures, 3920 Topics in Archaeology, 4100 Amer Indian Political Issues

Major Electives—3 credits

- Modern Language .................................. 6

Concentration Requirements—33 credits

SS 3200 Historical Archaeology ............................. 3
SS 3500 Modern American History .......................... 3
SS 3550 Europe to 1650 ................................ 3
SS 3551 Europe in the Modern Era ......................... 3
SS 4500 Historiography ................................ 3
Choose 1 of the following: ................................ 3

Choose 5 of the following: ................................ 15


Free Electives—18 credits

Total ................................. 124

Liberal Arts, BA

Liberal Arts Concentration

College of Sciences and Arts

The liberal arts program introduces many academic areas, including science, math, literature, the arts, languages, philosophy, and history. Complement your liberal arts education with technical courses, tailoring your program to fit your career goals. You can also take courses in other fields, such as engineering and business. This combination prepares you for careers in a variety of businesses, industries, or government agencies, research organizations, and educational institutions. A liberal arts degree can also lead to graduate studies in law, medicine, or other fields.
Total Credits Required: 128

Major Requirements—70 credits
FA 2090 Speech Comm OR HU 2830 Intro to Speech Comm .......................... 3
HU 2505 Science, Technology, and Humanities I ........................................... 3
HU 2506 Science, Technology, and Humanities II ........................................... 3
HU 2700 Introduction to Philosophy ................................................................ 3
HU 3261 Intercultural Communication ......................................................... 3
HU 3629 Practical Writing ................................................................................ 3
HU 4071 Liberal Arts Capstone Project .......................................................... 3
RHETORIC OR LINGUISTICS ............................................................................... 3
HU 2130 Intro to Rhet, 2510 Lang & Mind, 2920 Lang & Soc, 3130 Rhet Theory & Criticism, 3150 Reading & Writing, 3151 Rhet of Everyday Texts, 3910 Lang in the World, 3920 Lang & Tech, 3930 Lang & Educ, 4130 Spec Topics in Rhet/Comp, 4150 Literacy in the Content Areas .............................. 3

COMMUNICATIONS ......................................................................................... 3

AMERICAN LITERATURE .................................................................................. 3
HU 2501 Amer Exp in Lit I, 2502 Amer Exp in Lit II, 2517 Anglo-Amer Lit Studies, 2520 Cultural Diversity in Amer Lit, 3510 The Amer Novel, 3541 Major Amer Authors, 4542 Topics in Amer Lit .................................................. 3

British Literature ............................................................................................... 3
HU 2538 Brit Exp in Lit I, 2539 Brit Exp in Lit II, 3512 Shakespeare I, 3513 Shakespeare II, 3540 Maj Brit Authors, 3551 Ren Lit, 3553 19th Century Brit Lit, 3554 Contemp Brit Authors, 3555 20th Century Brit Lit .................................................. 3

WORLD LITERATURE ....................................................................................... 3
HU 2547 World Drama, 2548 Adolescent Lit, 3251 Mod Masters, 3252 Lit in Tran, 3561 Medieval Lit, 3562 World Mythologies, 3504 Novels from World Lit, 4545 Topics in World Lit .................................................. 3

PHILOSOPHY ..................................................................................................... 6
HU 2701 Logic and Critical Thinking, 3700 Phil of Sci, 3701 Phil of Tech, 3710 Engg Ethics, 3711 Biomed Ethics, 4700 Topics in Phil, 4701 Political Phil, 4702 Environ Phil, 4703 Issues in Comm Ethics .......................... 6

VISUAL OR PERFORMING ARTS ................................................................... 3

Social Sciences ................................................................................................. 6
Science and Mathematics .............................................................................. 16
Choose 3 cr lab science, 3 cr math, and 10 cr in science, math, or cs. ................................. 16

Concentration Requirements—24 credits
Complete 24 cr by choosing from the following:
• Create, in consultation with advisor and with advisor’s permission, a concentration (24 cr), which is any collection of courses that can be shown to contribute to the student’s expertise in one area. Choose courses from more than one department and you may include humanities courses.
• Earn a Certificate in Modern Language and Area Study.
• Take a minor and supplement it with extra courses to add up to 24 cr. The minor must include a minimum of 18 cr and must be from a field outside liberal arts, but it may be one offered by the humanities department. The minor alone will not meet this requirement.
• Earn a Certificate in Media or in Writing, or both. These certificates require 21 cr, but 6 cr from each of these certificates may count toward the major requirements for this degree.

Free Electives—3 credits

General Education Requirements—31 credits*
CORE ................................................................................................................. 16
UN 1001 Perspectives on Inquiry .................................................................... 3
UN 1002 World Cultures* ................................................................................ 1
Modern Languages* ....................................................................................... 6
UN 2001 Revisions .......................................................................................... 3
UN 2002 Institutions ......................................................................................... 3

DISTRIBUTION COURSES ................................................................................. 15
Students must take two courses each from two different lists, one that has World Cultures as a prerequisite and one that has Institutions as a prerequisite. The fifth course can come from any list. See the General Education section for specific lists and allowed courses. This program requires the following as a distribution course:
PSY 2000 Principles of Psychology ................................................................ 3

Science/Math—Satisfied by major requirements above.

Co-Curricular Activities—3 units
Currently only PE classes qualify; units are required for graduation, but are not included in the calculation of the GPA, or in the overall credits required for the degree.

Liberal Arts Model Schedule—example only; actual schedule may vary. Include 3 units of co-curricular activities.

1st Year Fall
FA 2090 CR HU 2830 .................................................................................. 3
UN 1001 ...................................................................................................... 3
Math Requirement .......................................................................................... 3
Modern LanguageReq .................................................................................... 3
Science Lab Requirement .............................................................................. 4
Total ............................................................................................................. 16

1st Year Spring
HU 2505 ...................................................................................................... 3
UN 1003 and Modern Lang Req .................................................................... 4
American Lit Elective ..................................................................................... 3
Math Requirement .......................................................................................... 3
Science Requirement ..................................................................................... 3
Total ............................................................................................................. 16

2nd Year Fall
HU 2506 ...................................................................................................... 3
UN 2001 ...................................................................................................... 3
Brit Lit Elective ............................................................................................... 3
Concentration Elective ................................................................................... 3
CS Requirement ............................................................................................. 3
Philosophy Elective ......................................................................................... 3
Total ............................................................................................................. 18

2nd Year Spring
General Ed Distribution .................................................................................. 3
HU 3261 ...................................................................................................... 3
UN 2002 ...................................................................................................... 3
Concentration Elective ................................................................................... 3
Visual or Performing Arts Elect .................................................................... 3
World Lit Elective ........................................................................................... 3
Total ............................................................................................................. 15

3rd Year Fall
PSY 2000 ...................................................................................................... 3
Concentration Elective ................................................................................... 3
Literature Elective ............................................................................................ 3
Philosophy Elective ........................................................................................ 3
Upper-DV History Elective (SS) .................................................................... 3
Writing Elective ............................................................................................... 3
Total ............................................................................................................. 18

3rd Year Spring
General Ed Distribution .................................................................................. 3
Concentration Elective ................................................................................... 3
Concentration Elective ................................................................................... 3
European History Elective (SS) ...................................................................... 3
Fine Arts Elective ............................................................................................ 3
Total ............................................................................................................. 15

4th Year Fall
General Ed Distribution .................................................................................. 3
Concentration Elective ................................................................................... 3
Visual or Performing Arts Elect .................................................................... 3
World Lit Elective ........................................................................................... 3
Total ............................................................................................................. 15

4th Year Spring
General Ed Distribution .................................................................................. 3
HU 4071 ...................................................................................................... 3
Concentration Elective ................................................................................... 3
Concentration Elective ................................................................................... 3
Visual or Performing Arts Elect .................................................................... 3
Total ............................................................................................................. 15

* UN 1002 is waived for this degree, which requires 6 credits of modern language and UN 1003.

Materials Science and Engineering, BS

MATERIALS SCIENCE & ENGINEERING CONCENTRATION

College of Engineering

Students in the Materials Science and Engineering option learn how to control the properties of various engineering materials through composition and processing, essential to ensure that the properties of a material or component (e.g., strength, ductility, corrosion resistance, electrical properties, etc.) are suitable for an intended engineering application. Undergraduate instruction covers all classes of engineering materials (metals and alloys, ceramics, electronic materials, polymers, and composites) and emphasizes the broad principles that govern structure-property-processing-performance relationships in these materials. Students are introduced to state-of-the-art techniques for producing, characterizing, and testing engineering materials and components.

Total Credits Required: 128

Major Requirements—70 credits
OH 1110 University Chemistry I .................................................................... 4
OH 1111 University Chemistry Lab I .............................................................. 1
OH 1120 University Chemistry II .................................................................... 4
ENG 1101 Fundamentals of Engineering I .................................................. 3
ENG 1102 Fundamentals of Engineering II ................................................. 3
MA 1150 Calculus I OR MA 1160 Calculus with Technology I .................. 4
MA 2150 Calculus II OR MA 2160 Calculus with Technology II .............. 4
MA 2320 Elementary Linear Algebra ....................................................... 2
MA 3150 Multivar Calc OR MA 3160 Multivar Calc with Tech .................. 4
MA 3520 Elementary Differential Equations ............................................ 2
MEEM 2120 Statics Strength of Materials ............................................... 4
PH 1200 Intro to Minerals and Materials Proc ........................................ 3
PH 2200 Univ Physics II-Elec & Magnetism ............................................ 3
PH 2400 Univ Physics IV-Waves and Mod Physics ............................... 2

Approved electives ................................................................. 7

Any 3000 or higher level course in engineering, science or mathematics

Concentration Requirements—27 credits
QM 4610 Intro to Polymer Science ....................................................... 3
MA 3710 Engineering Statistics ........................................................... 3
MA 3210 Materials Characterization II .................................................. 4
MY 3900 Design of Microstructure ....................................................... 3
MY 3400 Mechanical Properties of Materials ........................................ 3
MY 4700 Electronic Properties of Materials ........................................... 2
MY 4800 Material and Process Selection in Design ............................... 3
MY 4900 Mat Sci & Engg Capstone Design Project I ............................ 3
MY 4910 Mat Sci & Engg Capstone Design Project II ............................ 3

Free Electives—3 credits
General Education Requirements—28 credits

CORE ................................................................. 13
UN 1001 Perspectives on Inquiry ......................................................... 3
UN 1002 World Cultures .................................................................. 4
UN 2001 Revisions .................................................................... 3
UN 2002 Institutions .................................................................. 3
Note: Two semesters of a single modern language (6 cr) in addition to UN 1003 World Cultures Activities (1 cr) can substitute for UN 1002.

DISTRIBUTION COURSES .......................................................... 15
Students must take two courses each from two different lists, one that has World Cultures as a prerequisite and one that has Institutions as a prerequisite. The fifth course can come from any list. See the General Education section for specific lists and allowed courses. This program requires the following as a distribution course:
EC 2000 Principles of Economics ....................................................... 3

SCIENCE/MATH—Satisfied by major requirements above.

Co-Curricular Activities—3 units
Currently only PE classes qualify; units are required for graduation, but are not included in the calculation of the GPA, or in the overall credits required for the degree.

Materials Science and Engineering Model Schedule—example only; actual schedule may vary. Include 3 units of co-curricular activities.

1st Year Fall 2nd Year Fall
CH 1110 .............................................. 4 MA 3150 OR 3160 ...................... 4
CH 1111 ........................................... 1 MA 2200 ................................... 3
ENG 1101 ....................................... 3 MY 2200 ..................................... 4
MA 1150 OR 1160 .................................. 4 PH 2200 .................................... 3
PH 1100 ........................................... 1 UN 2002 ................................... 3
UN 1001 ........................................... 3 Total ....................................... 17
Total .................................................... 16 2nd Year Spring
CH 1120 ........................................... 4 EC 2000 .................................... 3
ENG 1102 ........................................... 3 MA 2320 .................................... 2
MA 2150 OR 2160 ................................... 4 MY 3250 .................................... 2
PH 2100 ........................................... 3 MY 2100 .................................... 3
UN 1002 ........................................... 3 UN 2001 .................................... 3
Total .................................................... 15 Total ....................................... 17

1st Year Spring
EC 2000 ........................................... 3
MA 2150 OR 2160 ................................... 4
PH 1200 ........................................... 1
PH 2100 ........................................... 3
UN 1002 ........................................... 3
Total .................................................... 15

3rd Year Fall
General Ed Distribution ......................................................... 3
MA 3710 ........................................... 3
MY 3100 ........................................... 4
MY 3200 ........................................... 4
PH 2400 ........................................... 2
Total .................................................... 16
Total .................................................... 17

3rd Year Spring
General Ed Distribution ......................................................... 3
MA 3110 ........................................... 4
MY 3210 ........................................... 4
MY 3300 ........................................... 3
MY 3400 ........................................... 3
Total .................................................... 15

4th Year Fall
General Ed Distribution ......................................................... 3
MA 3710 ........................................... 3
MY 3100 ........................................... 4
MY 4700 ........................................... 2
MY 4900 ........................................... 3
PH 2400 ........................................... 2
Technical and Free Electives ......................................................... 4
Total .................................................... 17

Materials Science and Engineering, BS

MATERIALS SCIENCE AND ENGINEERING

ENGINEERING ENTERPRISE CONCENTRATION

College of Engineering

Total Credits Required: 131

Major Requirements—66 credits
CH 1110 University Chemistry I ..................................................... 4
CH 1111 University Chemistry Lab I ................................................ 1
CH 1120 University Chemistry II .................................................... 4
ENG 1101 Fundamentals of Engineering I ........................................ 3
ENG 1102 Fundamentals of Engineering II ....................................... 3
MA 1150 Calculus I OR MA 1160 Calculus with Technology I ........... 4
MA 2150 Calculus II OR MA 2160 Calculus with Technology II ......... 4
MA 2320 Elementary Linear Algebra .............................................. 2
MA 3150 Multivar Calc OR MA 3160 Multivar Calc with Tech .......... 4
MA 3520 Elementary Differential Equations ..................................... 2
MEEM 2120 Statics Strength of Materials .......................................... 3
MY 2100 Intro to Mat Sci and Engineering ....................................... 3
MY 2200 Intro to Minerals and Mat Proc .......................................... 3
MY 3100 Materials Processing I ..................................................... 4
MY 3110 Materials Processing II ..................................................... 4
MY 3200 Materials Characterization I ............................................. 4
PH 1100 Introductory Physics Lab I .................................................. 1
PH 1200 Introductory Physics Lab II ............................................... 1
PH 2100 Univ Phys I-Mechanics ..................................................... 3
PH 2200 Univ Phys II-Elec & Magnetism .......................................... 3
PH 2400 Univ Phys IV-Waves & Modern Physics ............................ 2
Approved electives ................................................................. 4

Any 3000 or higher level course in engineering, science or mathematics

Concentration Requirements—37 credits
QM 4610 Intro to Polymer Science ..................................................... 3
EC 2000 Principles of Economics ..................................................... 3
ENG 2860 Engineering Enterprise Orientation ..................................... 1
ENG 2950 Engineering Enterprise Project Work I .............................. 1
ENG 3950 Engineering Enterprise Project Work II ............................. 1
ENG 3960 Engineering Enterprise Project Work III ......................... 1
ENG 4950 Engineering Enterprise Project Work IV .......................... 2
ENG 4960 Engineering Enterprise Project Work V ........................... 2
MA 3710 Engineering Statistics ...................................................... 3
MY 3210 Materials Characterization II ........................................... 4
MY 3300 Design of Microstructure ................................................. 3
ME 3400 Mechanical Properties of Materials .................................. 3
MY 4700 Electronic Properties of Materials .................................... 2
MY 4800 Material and Process Selection in Design .......................... 3
Approved elective modules .......................................................... 5
ENG 3401 Econ Decision Anal I, 3402 Econ Decision Anal II, 3403 Econ
Decision Anal III, 3954 Enterprise Market Principles, 3955 Concept Design
Problem Solving, 3956 Industrial Health and Safety, 3961 Engg Ent Strat
Leadership, 3964 Project Management, 3965 Material Row Ind Society, 3966
Design for Manufacturing, 3970 Enterprise Spec Topics, 4951 Budgeting Entrepre
Engg, 4952 Complex Comm Practices, 4953 Writing Engg Societal Context, 4954
Global Competition, 4970 Enterprise Spec Topics
Free Electives—0 credits

<table>
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Note: Two semesters of a single modern language (6 cr) in addition to UN 1003 World Cultures Activities (1 cr) can substitute for UN 1002.

DISTRIBUTION COURSES: 15

Students must take two courses each from two different lists, one that has World Cultures as a prerequisite and one that has Institutions as a prerequisite. The fifth course can come from any list. See the General Education section for specific lists and allowed courses. This program requires the following in place of the fifth course:

- ENG 2961 Team in the Engineering Enterprise
- ENG 2962 Communication Contexts
- ENG 3962 Communication Strategies

SCIENCE/MATH—Satisfied by major requirements above.

Co-Curricular Activities—3 units

Currently only PE classes qualify; units are required for graduation, but are not included in the calculation of the GPA, or in the overall credits required for the degree.

Materials Science & Engg Enterprise Model Schedule—example only; actual schedule may vary. Include 3 units of co-curricular activities.

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2nd Year Fall

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3rd Year Spring

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4th Year Spring

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Materials Science and Engineering, BS

MINERAL PROCESS ENGINEERING CONCENTRATION

College of Engineering

The Mineral Process Engineering option emphasizes the use of sophisticated technologies for extraction and refining of valuable minerals from raw ores. Undergraduate instruction in this degree option emphasizes the principles and unit operations used for processing minerals. Students also receive instruction on environmental protection and cleanup, and waste material processing.

Total Credits Required: 128

Major Requirements—68 credits

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<td>CH 1120 University Chemistry II</td>
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<td>ENG 1101 Fundamentals of Engineering I</td>
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<td>ENG 1102 Fundamentals of Engineering II</td>
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<tr>
<td>MA 1150 Calculus I OR MA 1160 Calculus with Technology I</td>
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Concentration Requirements—29 credits

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<td>MY 3520 Sampling and Data Analysis</td>
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<td>MY 4100 Primary Metals Processing</td>
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<td>MY 4500 Particle Technology</td>
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Free Electives—3 credits

<table>
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<tr>
<td>General Education Requirements—28 credits</td>
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<td>Core:</td>
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<tr>
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<td>UN 2002 Institutions</td>
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</table>

Note: Two semesters of a single modern language (6 cr) in addition to UN 1003 World Cultures Activities (1 cr) can substitute for UN 1002.

Distribution Courses: 15

Students must take two courses each from two different lists, one that has World Cultures as a prerequisite and one that has Institutions as a prerequisite. The fifth course can come from any list. See the General Education section for specific lists and allowed courses. This program requires the following as a distribution course:

EC 2000 Principles of Economics | 3 |

Science/Math—Satisfied by major requirements above.

Co-Curricular Activities—3 units

Currently only PE classes qualify; units are required for graduation, but are not included in the calculation of the GPA, or in the overall credits required for the degree.

Mineral Process Engineering Model Schedule—example only; actual schedule may vary. Include 3 units of co-curricular activities.

1st Year Fall

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<th>Course</th>
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1st Year Spring
### Materials Science and Engineering, BS

#### MINERAL PROCESS ENGINEERING

#### ENGINEERING ENTERPRISE CONCENTRATION

**College of Engineering**

**Total Credits Required:** 130  
**Major Requirements—63 credits**

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**Concentration Requirements—39 credits**

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<tr>
<td>MY 3220</td>
<td>Ore Characterization Methods</td>
<td></td>
</tr>
<tr>
<td>MY 3600</td>
<td>Sampling and Data Analysis</td>
<td></td>
</tr>
<tr>
<td>MY 4100</td>
<td>Primary Metals Processing</td>
<td></td>
</tr>
<tr>
<td>MY 4500</td>
<td>Particle Technology</td>
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</tr>
<tr>
<td>MY 4510</td>
<td>Hydrometallurgy</td>
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<tr>
<td>MY 4520</td>
<td>Mineral Process Engineering</td>
<td></td>
</tr>
</tbody>
</table>

**Approved elective modules—5 credits**


**Free Electives—0 credits**

### General Education Requirements—28 credits

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENG Electives</td>
<td></td>
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<tr>
<td>UN 1001</td>
<td>World Cultures</td>
<td></td>
</tr>
<tr>
<td>UN 2002</td>
<td>Institutions</td>
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**DISTRIBUTION COURSES**

- Students must take two courses each from four different lists, one that has World Cultures as a prerequisite and one that has Institutions as a prerequisite. The fifth course can come from any list. See the General Education section for specific lists and allowed courses. This program requires the following in place of the fifth course:
- ENG 2961 Teaming in the Engineering Enterprise
- ENG 2962 Communication Contexts
- ENG 3962 Communication Strategies

**SCIENCE/MATH**—Satisfied by major requirements above.

**Co-Curricular Activities—3 units**

- Currently only PE classes qualify; units are required for graduation, but are not included in the calculation of the GPA, or in the overall credits required for the degree.

**Mineral Process Engg Enterprise Model Schedule**—example only; actual schedule may vary. Include 3 units of co-curricular activities.

#### 1st Year

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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<tbody>
<tr>
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<tr>
<td>CH 1111</td>
<td>University Chemistry Lab I</td>
<td></td>
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<tr>
<td>ENG 1101</td>
<td>Fundamentals of Engineering I</td>
<td></td>
</tr>
<tr>
<td>ENG 1102</td>
<td>Fundamentals of Engineering II</td>
<td></td>
</tr>
<tr>
<td>MA 1150</td>
<td>Calculus I OR MA 1160 Calculus with Technology I</td>
<td></td>
</tr>
<tr>
<td>MA 2150</td>
<td>Calculus II OR MA 2160 Calculus with Technology II</td>
<td></td>
</tr>
<tr>
<td>PH 2400</td>
<td>Univ Physics I-Mechanics</td>
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<tr>
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#### 2nd Year

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<tr>
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<td>PH 2400</td>
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<tr>
<td>GE 2300</td>
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</tr>
<tr>
<td>MY 3220</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MY 3600</td>
<td></td>
<td></td>
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<td>MY 4100</td>
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<td></td>
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<tr>
<td>MY 4520</td>
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</table>

**General Education Requirements—General Education Course**

- Core: 13 credits
- UN 2002 World Cultures 3 credits
- UN 2001 Revisions 3 credits
- UN 2002 Institutions 3 credits

**2nd Year Fall**

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<thead>
<tr>
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<th>Course Title</th>
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<tbody>
<tr>
<td>CH 1120</td>
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#### 3rd Year

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<td>ENG 2962</td>
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<td>MA 2320</td>
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<td>MA 3520</td>
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<td>MY 2100</td>
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<tr>
<td>UN 2001</td>
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<tr>
<td>ENG Electives</td>
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#### 4th Year

<table>
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<tr>
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<tbody>
<tr>
<td>ENG 2960</td>
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<tr>
<td>ENG 2961</td>
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<td>ENG 2962</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MA 2320</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MA 3520</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MY 2100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>UN 2002</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ENG Electives</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ENG Electives</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ENG Electives</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>16–17</td>
</tr>
</tbody>
</table>

**Total Credits Required:** 130
Mathematics

When we asked one of our graduates, a medical insurance consultant, what you can do with a math major, her answer was “anything!” Mathematics is the language of science and engineering and a key tool for understanding the world we live in. Because mathematics is fundamental and flexible, you can combine it with any other interest. Are you interested in business or finance? Consider the actuarial science concentration. Science and engineering? Applied/computational mathematics. Computers? Discrete mathematics. Teaching? Secondary education. Medical research? Statistics. Or maybe you want a background in general mathematics. What do you want to do?

Mathematics, BS

**General Mathematics Concentration**

*College of Sciences and Arts*

**Total Credits Required: 124**

**Major Requirements—42 credits**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MA 1150 Calculus I OR MA 1160 Calculus with Technology I</td>
<td>4</td>
</tr>
<tr>
<td>MA 2150 Calculus II OR MA 2160 Calculus with Technology II</td>
<td>4</td>
</tr>
<tr>
<td>MA 2330 Honors Elementary Linear Algebra</td>
<td>3</td>
</tr>
<tr>
<td>MA 2710 Introduction to Statistical Analysis</td>
<td>3</td>
</tr>
<tr>
<td>MA 3150 Multivariable Calc OR MA 3160 Multivariable Calc with Tech</td>
<td>4</td>
</tr>
<tr>
<td>MA 3210 Introduction to Combinatorics</td>
<td>3</td>
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<tr>
<td>MA 3310 Introduction to Abstract Algebra</td>
<td>3</td>
</tr>
<tr>
<td>MA 3450 Introduction to Real Analysis</td>
<td>3</td>
</tr>
<tr>
<td>MA 3530 Intro to Diff Equat OR 3560 Mathematical Modeling</td>
<td>4</td>
</tr>
<tr>
<td>Lab Science (BL, CH, or PH)</td>
<td>4</td>
</tr>
<tr>
<td>CS programming course</td>
<td>3</td>
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<tr>
<td>Science, engineering, or CS</td>
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**Concentration Requirements—23 credits**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
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<tbody>
<tr>
<td>MA 4410 Complex Variables</td>
<td>3</td>
</tr>
<tr>
<td>MA 4900 Mathematical Sciences Project</td>
<td>2</td>
</tr>
<tr>
<td>MA 4209 Combinatorics and Graph Theory, 4308 Theory of Numbers OR 4908 Theory of Numbers with Tech, 4310 Abstract Algebra, 4330 Linear Algebra, 4450 Real Analysis</td>
<td>9</td>
</tr>
</tbody>
</table>

**Choose 2 of the following:**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MA 3202 Introduction to Coding Theory, 3203 Introduction to Cryptography, 3924 College Geometry with Tech, 4426 Differential Geometry, 4515 Intro Partial Diff Equat, 4525 Applied Vector &amp; Tensor Math, senior-level numerical analysis, senior-level math statistics</td>
<td>6</td>
</tr>
</tbody>
</table>

**Mathematical sciences elective**

3000-level or above

**Free Electives—31 credits**

**General Education Requirements—28 credits**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>UN 1001 Perspectives on Inquiry</td>
<td>3</td>
</tr>
<tr>
<td>UN 1002 World Cultures</td>
<td>4</td>
</tr>
<tr>
<td>UN 2001 Revisions</td>
<td>3</td>
</tr>
<tr>
<td>UN 2002 Institutions</td>
<td>3</td>
</tr>
</tbody>
</table>

Note: Two semesters of a single modern language (6 cr) in addition to UN 1003 World Cultures Activities (1 cr) can substitute for UN 1002.

**DISTRIBUTION COURSES**

- Students must take two courses each from two different lists, one that has World Cultures as a prerequisite and one that has Institutions as a prerequisite. The fifth course can come from any list. See the General Education section for specific lists and allowed courses.

**Science/Math—Satisfied by major requirements above.**

**Co-Curricular Activities—3 units**

Currently only PE classes qualify; units are required for graduation, but are not included in the calculation of the GPA, or in the overall credits required for the degree.

---

**General Mathematics Model Schedule**—example only; actual schedule may vary. Include 3 units of co-curricular activities.

<table>
<thead>
<tr>
<th>1st Year Fall</th>
<th>4th Year Fall</th>
</tr>
</thead>
<tbody>
<tr>
<td>MA 1150</td>
<td>MA 4900</td>
</tr>
<tr>
<td>MA 2150</td>
<td>MA 4900</td>
</tr>
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<td>MA 2330</td>
<td>MA 4900</td>
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<tr>
<td>MA 2710</td>
<td>MA 4900</td>
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<td>MA 4900</td>
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<td>MA 3210</td>
<td>MA 4900</td>
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<td>MA 3310</td>
<td>MA 4900</td>
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<td>MA 3450</td>
<td>MA 4900</td>
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<tr>
<td>MA 3530</td>
<td>MA 4900</td>
</tr>
<tr>
<td>Lab Science Requirement</td>
<td>MA 4900</td>
</tr>
<tr>
<td>Free Elective</td>
<td>MA 4900</td>
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<tr>
<td>Free Elective</td>
<td>MA 4900</td>
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<tr>
<td>Free Elective</td>
<td>MA 4900</td>
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<tr>
<td>Total</td>
<td>MA 4900</td>
</tr>
</tbody>
</table>

---

**Actuarial Science Concentration**

*College of Sciences and Arts*

**Total Credits Required: 124**

**Major Requirements—42 credits**

See General Concentration

**Concentration Requirements—30 credits**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BA 2300 Accounting Principles I</td>
<td>3</td>
</tr>
<tr>
<td>BA 2310 Accounting Principles II</td>
<td>3</td>
</tr>
<tr>
<td>BA 2500 Business Law I</td>
<td>3</td>
</tr>
<tr>
<td>BA 3400 Managerial Finance</td>
<td>3</td>
</tr>
<tr>
<td>BA 4400 Investment Analysis</td>
<td>3</td>
</tr>
<tr>
<td>MA 3720 Probability</td>
<td>3</td>
</tr>
<tr>
<td>MA 3810 Theory of Interest</td>
<td>3</td>
</tr>
<tr>
<td>MA 4810 Life Contingencies</td>
<td>3</td>
</tr>
<tr>
<td>MA 4820 Loss Distr/Credibility Theory</td>
<td>3</td>
</tr>
<tr>
<td>MA 4830 Risk Theory/Survival</td>
<td>3</td>
</tr>
</tbody>
</table>

**Free Electives—24 credits**

See General Concentration. This program also requires the following as one of the distribution courses:

**EC 2000 Principles of Economics**

**Co-Curricular Activities—3 units**

See General Concentration

**Actuarial Science Model Schedule**—example only; actual schedule may vary. Include 3 units of co-curricular activities.

<table>
<thead>
<tr>
<th>1st Year Fall</th>
<th>1st Year Spring</th>
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<tbody>
<tr>
<td>MA 1150</td>
<td>MA 2160</td>
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<tr>
<td>MA 1160</td>
<td>MA 2330</td>
</tr>
<tr>
<td>MA 1910 OR Free Elective</td>
<td>MA 4900</td>
</tr>
<tr>
<td>UN 1001</td>
<td>MA 4900</td>
</tr>
<tr>
<td>UN 1002</td>
<td>MA 4900</td>
</tr>
<tr>
<td>Lab Science Requirement</td>
<td>MA 4900</td>
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<tr>
<td>Free Elective</td>
<td>MA 4900</td>
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**Baccalaureate Degree Requirements** 45
Mathematics, BS

**APPLIED/COMPUTATIONAL CONCENTRATION**

*College of Sciences and Arts*

<table>
<thead>
<tr>
<th>Total Credits Required: 124</th>
</tr>
</thead>
<tbody>
<tr>
<td>Major Requirements—42 credits</td>
</tr>
</tbody>
</table>

See General Concentration

**Concentration Requirements—18 credits**

- MA 4410 Complex Variables
- MA 4515 Introduction to Partial Differential Equations
- MA 4900 Mathematical Sciences Project

Choose 2 of the following:

- MA 4610 Numerical Linear Algebra
- MA 4625 Finite Difference Meth & PDEs
- MA 4626 Finite Element Methods
- MA 4630 Comp Industrial Math I
- MA 4631 Comp Industrial Math II

Choose 1 of the following:

- MA 4520 Integral Trans & Series Meth
- MA 4522 Applied Vector & Tensor Math
- MA 4535 Dynamic Sys: Control & Chaos
- MA 4540 Waves & Solitons
- MA 4545 Math II

**Free Electives—36 credits**

General Education Requirements—28 credits

See General Concentration

Co-Curricular Activities—3 units

See General Concentration

**Applied/Computational Model Schedule**—example only; actual schedule may vary. Include 3 units of co-curricular activities.

<table>
<thead>
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<tbody>
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<td>MA 3160</td>
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<tr>
<td>MA 1160</td>
<td>MA 3210</td>
</tr>
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<td>MA 1910 OR Free Elective</td>
<td>UN 2001</td>
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<td>UN 1001</td>
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<td>Sci/Eng/CS Requirement</td>
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<td>MA 3560</td>
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<tr>
<td>UN 1002</td>
<td>UN 2002</td>
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<table>
<thead>
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<tbody>
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<thead>
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<tr>
<td>General Ed Distribution</td>
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<td>MA Concentration Elective</td>
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<table>
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<tr>
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<tr>
<td>MA Concentration Elective</td>
<td>See General Concentration</td>
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<tr>
<td>Free Electives</td>
<td>Concentration Requirements—18 credits</td>
</tr>
<tr>
<td>MA 4208 Optimization/Graph Algorithms</td>
<td>MA 4310 Abstract Algebra</td>
</tr>
<tr>
<td>MA 4209 Combinatorics and Graph Theory</td>
<td>MA 4330 Linear Algebra</td>
</tr>
<tr>
<td>MA 4211 Inform Theory/Data Compression, 4308 Theory of Numbers</td>
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</tr>
<tr>
<td>Free Electives—36 credits</td>
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</tbody>
</table>

General Education Requirements—28 credits

See General Concentration

Co-Curricular Activities—3 units

See General Concentration

**Discrete Model Schedule**

See model schedule for Applied/Computational Concentration. Include 3 units of co-curricular activities.

Mathematics, BS

**STATISTICS CONCENTRATION**

*College of Sciences and Arts*

<table>
<thead>
<tr>
<th>Total Credits Required: 124</th>
</tr>
</thead>
<tbody>
<tr>
<td>Major Requirements—42 credits</td>
</tr>
</tbody>
</table>

See General Concentration

**Concentration Requirements—18 credits**

- MA 3720 Probability
- MA 3730 Survey Methods & Data Analysis
- MA 4710 Regression Analysis
- MA 4720 Design and Analysis of Experiments
- MA 4760 Mathematical Statistics I
- MA 4770 Mathematical Statistics II

**Free Electives—36 credits**

General Education Requirements—28 credits

See General Concentration

Co-Curricular Activities—3 units

See General Concentration

**Statistics Model Schedule**

See model schedule for Applied/Computational Concentration. Include 3 units of co-curricular activities.
Mathematics, BS
SECONDARY EDUCATION—MATHEMATICS CONCENTRATION

College of Sciences and Arts

Total Credits Required: 124

Major Requirements—42 credits
See General Concentration

Concentration Requirements—46 credits
MA 1910 Exploring Symmetry Groups* .............................................. 3
MA 3924 College Geometry with Tech ............................................. 3
MA 4908 Theory of Numbers with Tech ......................................... 3
MA 4945 History of Mathematics .................................................. 3
4000-level Math Electives ......................................................... 6

EDUCATION DEPARTMENT REQUIREMENTS
ED 2100 Instructional Technology ................................................. 2
HU 4150 Literacy in the Content Areas ........................................... 4

Courses in each block must be taken concurrently.

EDUCATION EARLY BLOCK
ED 3110 Psych Round of Learning ................................................. 2
ED 3210 Foundations of Education .............................................. 2
ED 3310 Seminar in Education .................................................... 1
ED 3410 Clinical Experience ....................................................... 1

EDUCATION LATE BLOCK
ED 4810 Meth of Teaching Sci, Math, & CS ................................... 4
ED 4910 Directed Teaching ......................................................... 12

Free Electives—8 credits
See General Concentration. This program also requires the following as a distribution course:
PSY 2000 Principles of Psychology ................................................ 3

Co-Curricular Activities—3 units
See General Concentration

Mathematics Secondary Educ Model Schedule—example only; actual schedule may vary. Include 3 units of co-curricular activities.

Note: students need to plan for a teaching minor.

1st Year Fall
CS 1121 ............................................................ 3
MA 1160 ............................................................ 4
MA 1910 ............................................................ 3
UN 1001 ............................................................ 3
Free Elective ......................................................... 3
Total ................................................................. 16

1st Year Spring
ED 2020* .......................................................... 1
MA 2160 ............................................................ 4
MA 2230 ............................................................ 3
UN 1002 ............................................................ 4
Lab Science Requirement ....................................................... 4
Total ................................................................. 16

2nd Year Fall
MA 3160 ............................................................ 4
MA 3210 ............................................................ 3
PSY 2000 ............................................................ 3
UN 2001 ............................................................ 3
Sci/Eng/CS Requirement ......................................................... 3
Total ................................................................. 16

2nd Year Spring
ED 2100 ............................................................ 2
MA 2710 ............................................................ 3
MA 3560 ............................................................ 3
UN 2002 ............................................................ 3
Free Elective ......................................................... 3
Sci/Eng/CS Requirement ......................................................... 2
Total ................................................................. 16

3rd Year Fall
General Ed Distribution ......................................................... 3
Early Block Ed courses ......................................................... 6
MA 3310 ............................................................ 3
MA 3924 ............................................................ 3
Total ................................................................. 15

3rd Year Spring
General Ed Distribution ......................................................... 3
Early Block Ed Distribution ...................................................... 3
HU 4150 ............................................................ 4
MA 3450 ............................................................ 3
MA 4906 ............................................................ 3
Total ................................................................. 16

4th Year Fall
General Ed Distribution ......................................................... 3
4000-level MA Elective ......................................................... 6
MA 4945 ............................................................ 3
Free Elective ......................................................... 2
Total ................................................................. 14

4th Year Spring
ED 4810 ............................................................ 4
ED 4910 ............................................................ 12
Total ................................................................. 16

* or MA 1920, 1930, 1940, 2910, or 2920
** suggested by ED Dept.

Mechanical Engineering, BS
College of Engineering

Virtually every product or service in modern life has been touched in some way by mechanical engineering, which encompasses the design, analysis, testing, and manufacture of products. Mechanical engineers may design a component, a machine, a system, or a process and then analyze their designs using the principles of motion, energy, and force to ensure that the product functions safely, efficiently, reliably, and that it can be manufactured at a competitive cost. Mechanical engineers work in the automotive, aerospace, chemical, communication, paper, computer, power generation, and, increasingly, in the environmental and biomedical fields. They can also go to graduate school or work for research and development labs, government, business, or consulting firms.

Total Credits Required: 127

Major Requirements 87 credits
CH 1100 General Chemistry ....................................................... .4
BE 3010 Circuits and Instrumentation ......................................... 3
EN 1101 Fundamentals of Engineering I ...................................... 3
EN 1102 Fundamentals of Engineering II .................................... 3
MA 1150 Calc I OR MA 1160 Calc with Technology I .................... 4
MA 2150 Calc II OR MA 2160 Calc with Technology II ................ 4
MA 2320 Elem Linear Algebra OR MA 2330 Honors Elem Linear Algebra ......................................................... 2
MA 3150 Multivariable Calc OR MA 3160 Multivariable Calc with Tech .................................................. 4
MA 3520 Elementary Differential Equations ................................ 2
MA 3710 Engineering Statistics ............................................... 3
MEEM 2110 Statics .................................................................. 3
MEEM 2150 Mechanics of Materials ......................................... 3
MEEM 2200 Thermodynamics .................................................. 3
MEEM 2500 Integrated Design & Manufacturing ......................... 4
MEEM 2700 Dynamics ............................................................ 3
MEEM 3000 Mechanical Engg Laboratory ................................... 2
MEEM 3210 Fluid Mechanics .................................................... 3
MEEM 3220 Energy Laboratory .................................................. 1
MEEM 3230 Heat Transfer .......................................................... 3
MEEM 3501 Product Realization I .............................................. 3
MEEM 3502 Product Realization II ............................................. 3
MEEM 3700 Mechanical Vibrations ............................................ 3
MEEM 4700 Dynamic Systems and Controls ................................ 4
MEEM 4900 Senior Design ....................................................... 3
MEEM 4910 Senior Design II ..................................................... 3
MY 2100 Introductory to Materials Science and Engineering ........ 3
PH 1100 Introductory Physics Lab I .............................................. 1
PH 1200 Introductory Physics Lab II ............................................. 1
PH 2100 Univ Physics I-Mechanics ............................................. 3
PH 2200 Univ Physics II-Elec & Magnetism ................................ 3

Concentration Requirements—9 credits
Technical Electives ......................................................... 9
Free Electives—3 credits
See General Education Requirements—28 credits
Core: .................................................................................. 13
UN 1001 Perspectives on Inquiry ................................................ 3

BACCALAUREATE DEGREE REQUIREMENTS 47
UN 1002 World Cultures ........................................... 4
UN 2001 Revisions .............................................. 3
UN 2002 Institutions ........................................... 3
Note: Two semesters of a single modern language (6 cr) in addition to UN 1003 World Cultures Activities (1 cr) can substitute for UN 1002.
DISTRIBUTION COURSES ..................................... 15
Students must take two courses each from two different lists, one that has World Cultures as a prerequisite and one that has Institutions as a prerequisite. The fifth course can come from any list. See the General Education section for specific lists and allowed courses. This program requires the following as a distribution course:
EC 3400 Economic Decision Analysis ........................ 3
SCIENCE/MATH—Satisfied by major requirements above.

Co-Curricular Activities—3 units
Currently only PE classes qualify; units are required for graduation, but are not included in the calculation of the GPA, or in the overall credits required for the degree.

Mechanical Engineering Model Schedule—example only; actual schedule may vary. Include 3 units of co-curricular activities.

1st Year Fall
CH 1100 .................................................. 4
ENG 1101 .................................................. 3
MA 1150 OR 1160 .......................................... 4
PH 1100 .................................................. 1
UN 1001 ................................................... 3
Total ..................................................... 15

1st Year Spring
ENG 1102 .................................................. 3
MA 2150 OR 2160 .......................................... 4
PH 1200 .................................................. 1
PH 2100 .................................................. 1
UN 1002 ................................................... 4
Total ..................................................... 15

2nd Year Fall
MA 3150 OR 3160 .......................................... 4
MEEM 2110 ................................................ 3
MY 2100 .................................................. 3
PH 2200 .................................................. 3
UN 2001 ................................................... 3
Total ..................................................... 15

2nd Year Spring
MEEM 2150 ................................................ 3
MEEM 2200 ................................................ 3
MEEM 2500 ................................................ 4
MEEM 2700 ................................................ 3
UN 2002 ................................................... 3
Total ..................................................... 16

3rd Year Fall
EC 3400 ................................................... 3
EE 3010 ................................................... 3
MA 2320 OR 2330 ........................................ 2
MEEM 3210 ................................................ 3
MEEM 3220 ................................................ 1
MEEM 3510 ................................................ 3
Total ..................................................... 17

3rd Year Spring
General Ed Distribution ..................................... 3
MA 3710 ................................................... 3
MEEM 3000 ................................................ 2
MEEM 3230 ................................................ 3
MEEM 3502 ................................................ 3
MEEM 3700 ................................................ 3
Total ..................................................... 17

4th Year Fall
General Ed Distribution ..................................... 3
General Ed Distribution ..................................... 3
MEEM 4700 ................................................ 3
MEEM 4900 ................................................ 3
Tech Elective ............................................. 3
Total ..................................................... 16

4th Year Spring
MEEM 4910 ................................................ 3
Free Elective ............................................. 3
Tech Elective ............................................. 3
Tech Elective ............................................. 3
Total ..................................................... 15

MA 3520 Elementary Differential Equations .................. 2
MA 3710 Engineering Statistics .............................. 3
MEEM 2110 Statics .......................................... 3
MEEM 2150 Mechanics of Materials ........................ 3
MEEM 2200 Thermodynamics ............................... 3
MEEM 2500 Integrated Design & Manufacturing .......... 4
MEEM 2700 Dynamics ....................................... 3
MEEM 3000 Mechanical Engg Laboratory .................. 2
MEEM 3210 Fluid Mechanics ............................... 3
MEEM 3220 Energy Laboratory ............................. 1
MEEM 3230 Heat Transfer ................................... 3
MEEM 3501 Product Realization I ........................... 3
MEEM 3502 Product Realization II ........................... 3
MEEM 3700 Mechanical Vibrations .......................... 3
MEEM 4700 Dynamic Systems and Controls ............... 4
MY 2100 Intro to Materials Sci and Engg ................... 3
PH 1100 Introductory Physics Lab I ......................... 1
PH 1200 Introductory Physics Lab II ........................ 1
PH 2100 Univ Physic I-Mechanics ........................... 3
PH 2200 Univ Physics II-Bec & Magnetism ................ 3
Technical Electives ......................................... 6

Concentration Requirements—13 credits
ENG 2950 Engineering Enterprise Orientation ............. 1
ENG 2960 Engineering Enterprise Project Work I ........... 1
ENG 3950 Engineering Enterprise Project Work II ......... 1
ENG 3960 Engineering Enterprise Project Work III ......... 1
ENG 3990 Engineering Enterprise Project Work IV ........... 2
ENG 4960 Engineering Enterprise Project Work V .......... 2
Approved elective modules ................................... 5

Free Electives—0 credits

General Education Requirements—28 credits
CARE .............................. 13
UN 1001 Perspectives on Inquiry ......................... 3
UN 1002 World Cultures .................................... 4
UN 2001 Revisions ....................................... 3
UN 2002 Institutions ..................................... 3

DISTRIBUTION COURSES ..................................... 15
Students must take two courses each from two different lists, one that has World Cultures as a prerequisite and one that has Institutions as a prerequisite. The fifth course can come from any list. See the General Education section for specific lists and allowed courses. This program requires the following in place of the fifth course:
ENG 2961 Teamwork in the Engineering Enterprise .......... 1
ENG 2962 Communication Contexts .......................... 1
ENG 3962 Communication Strategies ........................ 1

SCIENCE/MATH—Satisfied by major requirements above.

Co-Curricular Activities—3 units
Currently only PE classes qualify; units are required for graduation, but are not included in the calculation of the GPA, or in the overall credits required for the degree.

Mechanical Engineering Model Schedule—example only; actual schedule may vary. Include 3 units of co-curricular activities.

1st Year Fall
CH 1100 .................................................. 4
EE 3010 ................................................... 3
ENG 1101 .................................................. 3
ENG 1102 .................................................. 3
MA 1150 .................................................. 3
MA 2150 .................................................. 4
MA 2320 .................................................. 2
MA 3160 .................................................. 4
Total ..................................................... 15

1st Year Spring
CH 1100 .................................................. 4
ENG 1101 .................................................. 3
MA 1150 OR 1160 ........................................ 4
MA 2150 OR 2160 ........................................ 4
MA 2320 .................................................. 2
MA 3160 .................................................. 4
Total ..................................................... 15
Mining Engineering, BS

College of Engineering

Mining engineers seek to supply society’s demand for minerals in the most efficient manner while protecting the environment. Their work encompasses prospecting for mineral deposits; planning, designing, and operating profitable mines; processing and marketing the extracted minerals; and restoring the land for other use. The mining industry has seen an increased demand for mining engineers, and the opportunities for international minerals-related careers are great. In addition to mining and industrial minerals companies, career opportunities are available in a vast number of areas such as consulting, environmental, construction, computers, business, and government. Mining engineers’ responsibilities require a broad knowledge of basic sciences and an understanding of engineering and economic principles. Communication skills and a comprehension of social factors are also important, since engineers often assume managerial functions, coordinating and supervising the work of more-specialized engineers and scientists.

Total Credits Required: 130

Major Requirements—89 credits

CH 1110 University Chemistry I ................................................. 4
CH 1111 University Chemistry I Lab .......................................... 1
CH 1120 University Chemistry II ............................................. 4
EE 3010 Circuits and Instrumentation .................................. 3
ENG 1101 Fundamentals of Engineering I ................................. 3
ENG 1102 Fundamentals of Engineering II ............................. 3
MA 1150 Calculus I OR MA 1160 Calculus with Technology I .... 4
MA 2150 Calculus II OR MA 2160 Calculus with Technology II ... 4
MA 2320 Elementary Linear Algebra .................................. 2
MA 3520 Elementary Differential Equations ......................... 2
MA 3710 Engineering Statistics ............................................ 3
MEEM 2120 Statics Strength of Materials ............................... 4
MEEM 2200 Thermodynamics ............................................. 3
MEEM 3210 Fluid Mechanics .............................................. 3
MG 2010 Safety in Engineering Practice ............................... 1
MG 2020 Intro to Mining Engg & Mining Methods ................. 3
MG 2400 Mining Geology ..................................................... 3
MG 2710 Computer Methods in Mining Engineering .............. 1
MG 3030 Project Evaluation and Cost Engineering ............... 3
MG 3300 Materials Handling and Transportation .................. 3
MG 3400 Drilling and Blasting ............................................ 3
MG 4200 Mine Environmental Engineering .......................... 3

Free Electives—4 credits

General Education Requirements—25 credits

CORE .................................................. 13
UN 1001 Perspectives on Inquiry ......................................... 3
UN 1002 World Cultures ................................................... 4
UN 2001 Revisions ......................................................... 3
UN 2002 Institutions ....................................................... 3

DISTRIBUTION COURSES .................................................. 15

Students must take two courses each from two different lists, one that has World Cultures as a prerequisite and one that has Institutions as a prerequisite. The fifth course can come from any list. See the General Education section for specific lists and allowed courses. This program requires the following as a distribution course:

GE 2200 Understanding the Earth ......................................... 3

Science/Math—Satisfied by major requirements above.

Co-Curricular Activities—3 units

Currently only PE classes qualify; units are required for graduation, but are not included in the calculation of the GPA, or in the overall credits required for the degree.

Mining Model Schedule—example only; actual schedule may vary. Include 3 units of co-curricular activities.

1st Year Fall

CH 1110 ............................................. 4
CH 1111 ............................................. 1
EE 3010 ............................................. 3
ENG 1101 ............................................ 3
MA 1150 OR MA 1160 ............................................... 4
MA 2320 ............................................. 2
MA 2320 ............................................. 2
MA 3710 ............................................. 3
Total .................................................. 15

2nd Year Fall

CH 1110 ............................................. 4
CH 1111 ............................................. 1
ENG 1101 ............................................ 3
MA 1150 OR MA 1160 ............................................... 4
PH 1100 ............................................. 1
UN 1001 ............................................. 3
Total .................................................. 16

1st Year Spring

ENG 1102 ............................................. 3
MA 2150 OR MA 2160 ............................................... 4
MG 2010 ............................................. 3
MG 2120 ............................................. 1
PH 1200 ............................................. 1
PH 2100 ............................................. 3
UN 1002 ............................................. 4
Total .................................................. 16

2nd Year Summer

SU 1300 ............................................. 2

BACCALAUREATE DEGREE REQUIREMENTS 49
### Mining Engineering, BS

#### Engineering Enterprise Concentration

**College of Engineering**

**Total Credits Required:** 130

<table>
<thead>
<tr>
<th>Major Requirements</th>
<th>86 credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH 1110 University Chemistry I</td>
<td>4</td>
</tr>
<tr>
<td>CH 1111 University Chemistry Lab I</td>
<td>1</td>
</tr>
<tr>
<td>CH 1120 University Chemistry II</td>
<td>4</td>
</tr>
<tr>
<td>EE 3010 Circuits and Instrumentation</td>
<td>3</td>
</tr>
<tr>
<td>ENG 1101 Fundamentals of Engineering I</td>
<td>3</td>
</tr>
<tr>
<td>ENG 1102 Fundamentals of Engineering II</td>
<td>3</td>
</tr>
<tr>
<td>MA 1150 Calculus I OR MA 1160 Calculus with Technology I</td>
<td>4</td>
</tr>
<tr>
<td>MA 2150 Calculus II OR MA 2160 Calculus with Technology II</td>
<td>4</td>
</tr>
<tr>
<td>MA 2320 Elementary Linear Algebra</td>
<td>2</td>
</tr>
<tr>
<td>MA 3520 Elementary Differential Equations</td>
<td>2</td>
</tr>
<tr>
<td>MA 3710 Engineering Statistics</td>
<td>3</td>
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<tr>
<td>MEEM 2120 Statics Strength of Materials</td>
<td>4</td>
</tr>
<tr>
<td>MEEM 2200 Thermodynamics</td>
<td>3</td>
</tr>
<tr>
<td>MEEM 3210 Fluid Mechanics</td>
<td>3</td>
</tr>
<tr>
<td>MG 2010 Safety in Engineering Practice</td>
<td>3</td>
</tr>
<tr>
<td>MG 2200 Intro to Mining Engg and Mining Methods</td>
<td>3</td>
</tr>
<tr>
<td>MG 2400 Mining Geology</td>
<td>3</td>
</tr>
<tr>
<td>MG 2710 Computer Methods in Mining Engineering</td>
<td>3</td>
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<td>MG 3030 Project Evaluation and Cost Engineering</td>
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<td>MG 3300 Materials Handling and Transportation</td>
<td>3</td>
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<tr>
<td>MG 3400 Drilling and Blasting</td>
<td>3</td>
</tr>
<tr>
<td>MG 4200 Mine Environmental Engineering</td>
<td>2</td>
</tr>
<tr>
<td>MG 4500 Rock Mechanics</td>
<td>3</td>
</tr>
<tr>
<td>MG 4510 Rock Mechanics Laboratory</td>
<td>1</td>
</tr>
<tr>
<td>MG 4700 Ore Reserve Analysis and Evaluation</td>
<td>2</td>
</tr>
<tr>
<td>MG 4800 Ventilation and Air Conditioning</td>
<td>2</td>
</tr>
<tr>
<td>MG 4910 Mine Design II</td>
<td>3</td>
</tr>
<tr>
<td>MY 2200 Intro to Minerals and Materials Processing</td>
<td>3</td>
</tr>
<tr>
<td>PH 1100 Introductory Physics Lab I</td>
<td>1</td>
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<tr>
<td>PH 1120 Introductory Physics Lab II</td>
<td>1</td>
</tr>
<tr>
<td>PH 2100 Univ Physcs I-Mechanics</td>
<td>3</td>
</tr>
<tr>
<td>PH 2200 Univ Physcs II-Elec &amp; Magnetism</td>
<td>3</td>
</tr>
<tr>
<td>SU 1300 Surveying Rld Fundamentals</td>
<td>2</td>
</tr>
</tbody>
</table>

**Concentration Requirements—16 credits**

| ENG 2950 Engineering Enterprise Orientation | 1 |
| ENG 2960 Engineering Enterprise Project Work I | 1 |
| ENG 3950 Engineering Enterprise Project Work II | 1 |
| ENG 3960 Engineering Enterprise Project Work III | 1 |
| ENG 4950 Engineering Enterprise Project Work IV | 2 |
| ENG 4960 Engineering Enterprise Project Work V | 2 |
| GE 2000 Understanding the Earth | 3 |
| Approved elective modules | 5 |
| ENG 3401 Econ Decision Analy I, 3402 Econ Decision Analy II, 3403 Econ Decision Analy III, 3954 Enterprise Market Principles, 3955 Concept Design | |

**Total Credits Required:** 130

*See Concentration Requirements lists.

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**Free Electives—0 credits**

**General Education Requirements—28 credits**

**Core**

| UN 1001 Perspectives on Inquiry | 3 |
| UN 1002 World Cultures | 4 |
| UN 2001 Revisions | 3 |
| UN 2002 Institutions | 3 |

Note: Two semesters of a single modern language (6 cr) in addition to UN 1003 World Cultures Activities (1 cr) can substitute for UN 1002.

**DISTRIBUTION COURSES**

- 1. Students must take two courses each from two different lists, one that has World Cultures as a prerequisite and one that has Institutions as a prerequisite. The fifth course can come from any list. See the General Education section for specific lists and allowed courses. This program requires the following in place of the fifth course:
  - UN 2001 Revisions
  - UN 2002 Institutions

**Science/Math—Satisfy by major requirements above.**

**Co-Curricular Activities—3 units**

Currently only PE classes qualify; units are required for graduation, but are not included in the calculation of the GPA, or in the overall credits required for the degree.

**Mining Engg Enterprise Model Schedule—example only; actual schedule may vary. Include 3 units of co-curricular activities.**

| 1st Year Fall | ENG 1110 | 1 |
| ENG 1111 | 1 |
| ENG 1101 | 3 |
| MA 1150 OR MA 1160 | 4 |
| ENG Electives | 1–3 |
| MA 3710 | 3 |
| UN 1001 | 3 |
| MY 2200 | 3 |
| Total | 15–16 |

| 2nd Year Fall | ENG 2950 | 1 |
| CH 1120 | 4 |
| ENG Electives | 1–3 |
| MA 2150 OR MA 2160 | 4 |
| MG 2010 | 3 |
| CH 1111 | 1 |
| ENG Electives | 1–3 |
| UN 1002 | 4 |
| MG 3400 | 3 |
| Total | 16 |

| 3rd Year Fall | ENG 2960 | 1 |
| ENG Electives | 1 |
| ENG Electives | 1 |
| MA 2200 | 2 |
| MY 2200 | 3 |
| MG 2710 | 3 |
| UN 2002 | 3 |
| Total | 16 |

| 4th Year Fall | SU 1300 | 2 |

| 1st Year Spring | ENG 1102 | 3 |
| MA 2150 OR MA 2160 | 4 |
| ENG 2950 | 1 |
| MG 2010 | 3 |
| PH 1200 | 1 |
| ENG Electives | 1–3 |
| MA 3710 | 3 |
| MEEM 3210 | 3 |
| MG 3300 | 3 |
| MG 4700 | 2 |
| Total | 17–18 |

| 2nd Year Spring | ENG 2960 | 1 |
| ENG Electives | 1 |
| ENG Electives | 1 |
| MA 2200 | 2 |
| MEEM 2120 | 4 |
| MG 2710 | 3 |
| UN 2002 | 3 |
| Total | 16 |

| 3rd Year Spring | ENG 2950 | 1 |
| General Ed Distribution | 3 |
| ENG Electives | 1–2 |
| MG 4200 | 2 |
| MG 4500 | 3 |
| MG 4510 | 1 |
| MG 4800 | 2 |
| Total | 14–15 |

| 4th Year Spring | ENG 2960 | 1 |
| General Ed Distribution | 3 |
| ENG Electives | 1–2 |
| MG 4910 | 3 |
| Total | 15–16 |

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Physics, BS

College of Sciences and Arts

This program provides a broad base in the physical sciences, mathematics, and humanities and is designed for those planning to continue with graduate work in physics. The junior and senior years provide an integrated study of both theoretical and experimental physics.

Total Credits Required: 128

Major Requirements—93 credits
CH 1110 University Chemistry I ...................................... 4
CH 1111 University Chemistry Lab I ............................ 1
CS 1010 Intro to Prog. for Engg and Applied Sci ... 3
MA 1150 Calculus I .................................................. 4
MA 2150 Calculus II .................................................. 4
MA 2320 Elementary Linear Algebra .......................... 2
MA 3150 Multivariable Calculus .................................. 4
MA 3530 Introduction to Differential Equations ........... 3
PH 1100H Introductory Physics Lab I ........................... 1
PH 1200H Introductory Physics Lab II Honors ............. 1
PH 2010 Sophomore Seminar ...................................... 1
PH 2100 Univ Physics I-Mechanics ............................ 3
PH 2200H Univ Physics II-Honors-Elec & Magnetism ... 3
PH 2230 Electronics for Scientists ............................ 4
PH 2300 Univ Physics III-Radiation & Thermodynamics ... 2
PH 2400 Univ IV-Waves & Modern Physics ................. 2
PH 3110 Theoretical Mechanics I .............................. 3
PH 3111 Theoretical Mechanics II ......................... 3
PH 3210 Geometrical and Physical Optics ................. 4
PH 3300 Thermodynamics and Statistical Mechanics ... 3
PH 3410 Quantum Physics I ...................................... 3
PH 3411 Quantum Physics II ..................................... 3
PH 3480 Modern Physics Laboratory ........................ 2
PH 4010 Senior Physics Colloquium I ....................... 1
PH 4011 Senior Physics Colloquium II ...................... 1
PH 4050 Qualitative Methods in Physics ................. 1
PH 4080 Senior Research I ...................................... 3
PH 4081 Senior Research II .................................. 3
PH 4210 Electricity and Magnetism I ....................... 3
PH 4211 Electricity and Magnetism II ................... 3

Physics electives ................................................. 6

Choose 9 credits from the following: ........................................... 9
CS 2911 Intro to Numerical Methods with Fortran, MA 4515 Intro to Partial Diff Equat, MA 4520 Integral Transforms, Special Functions, & Series
Solutions to ODEs & Asymptotics, MA 4525 Applied Vector & Tensor Math
MA 4635 Numerical Methods for Integral Equations

General Education Requirements—28 credits
Core ................................................................. 13
UN 1001 Perspectives on Inquiry ..................................... 3
UN 1002 World Cultures ........................................ 3
UN 2001 Revisions ................................................ 3
UN 2002 Institutions ............................................. 3

Note: Two semesters of a single modern language (6 cr) in addition to UN 1003 World Cultures Activities (1 cr) can substitute for UN 1002.

DISTRIBUTION COURSES ............................................. 15

Students must take two courses each from two different lists, one that has World Cultures as a prerequisite and one that has Institutions as a prerequisite. The fifth course can come from any list. See the General Education section for specific lists and allowed courses.

SCIENCE/MATH—Satisfied by major requirements above.

Co-Curricular Activities—3 units
Currently only PE classes qualify; units are required for graduation, but are not included in the calculation of the GPA, or in the overall credits required for the degree.

Physics Model Schedule—example only; actual schedule may vary. Include 3 units of co-curricular activities.

Calculus Start
1st Year Fall
CH 1110 ......................................................... 4
CH 1111 ......................................................... 1
CS 1010 ......................................................... 3
MA 1150 OR 1151 ........................................... 4-5
PH 1100H ......................................................... 1
UN 1001 ......................................................... 3
Total ......................................................... 16-17

1st Year Spring
MA 2150 ......................................................... 4
PH 1200H ......................................................... 1
PH 2100H ......................................................... 3
UN 1002 ......................................................... 4
Free Elective .................................................. 4
Total ......................................................... 16

2nd Year Fall
General Ed Distribution ....................................... 3
MA 2320 ......................................................... 2
MA 3150 ......................................................... 4
PH 2010 ......................................................... 1
PH 2200H ......................................................... 3
UN 2001 OR 2002 ....................................... 3
Total ......................................................... 16

2nd Year Spring
General Ed Distribution ....................................... 3
MA 2320 ......................................................... 2
PH 2300 ......................................................... 2
PH 2400 ......................................................... 2
UN 2002 OR 2001 ....................................... 3
Total ......................................................... 14

3rd Year Fall
General Ed Distribution ....................................... 3
PH 3110 ......................................................... 3
PH 3210 ......................................................... 4
PH 3410 ......................................................... 3
Free Elective .................................................. 3
Total ......................................................... 16

3rd Year Spring
General Ed Distribution ....................................... 3
PH 3111 ......................................................... 3
PH 3300 ......................................................... 3
PH 3411 ......................................................... 3
PH 3480 ......................................................... 2
Technical Elective ........................................... 3
Total ......................................................... 17

Precalculus Start
1st Year Fall
CH 1110 ......................................................... 4
CH 1111 ......................................................... 1
CS 1010 ......................................................... 3
MA 1033 ......................................................... 3
PH 1100H ......................................................... 1
UN 1001 ......................................................... 3
Total ......................................................... 15

1st Year Spring
General Ed Distribution ....................................... 3
MA 1150 ......................................................... 4
PH 1200H ......................................................... 1
UN 1002 ......................................................... 4
Free Elective .................................................. 4
Total ......................................................... 13

1st Year Summer
MA 2150 ......................................................... 4
PH 2100 ......................................................... 3
Total ......................................................... 7

Remainder of the Precalculus Start is the same as the Calculus Start.

3rd Year Spring
General Ed Distribution ....................................... 3
PH 3111 ......................................................... 3
PH 3300 ......................................................... 3
PH 3411 ......................................................... 3
PH 3480 ......................................................... 2
Technical Elective ........................................... 3

Total Credits Required: 128

Major Requirements—78 credits
CH 1110 University Chemistry I ............................ 4
CH 1111 University Chemistry Lab I ........................... 1
CS 1010 Intro to Prog. for Engg and Applied Sci ........ 3
MA 1150 Calculus ............................................. 4
MA 2150 Calculus ............................................. 4

Physics, Applied, BS

College of Sciences and Arts

Students in applied physics also receive a rigorous program in physics and mathematics with provision for study for another science or branch of engineering. Employment may be found in laboratories or in industry where interdisciplinary training is of particular importance or, if qualified, students can go on to graduate school.

Total Credits Required: 128

Major Requirements—78 credits
CH 1110 University Chemistry I ............................ 4
CH 1111 University Chemistry Lab I ........................... 1
CS 1010 Intro to Prog. for Engg and Applied Sci ........ 3
MA 1150 Calculus ............................................. 4
MA 2150 Calculus ............................................. 4
MA 2320 Elementary Linear Algebra .................................. 2
MA 3150 Multivariable Calculus ................................. 4
MA 3530 Introduction to Differential Equations ............. 3
PH 1100H Introductory Physics Lab I Honors .............. 1
PH 1200H Introductory Physics Lab II Honors .......... 1
PH 2010 Seminar ..................................................... 1
PH 2100 Univ Physics I Honors-Mechanics ..................... 3
PH 2200 Univ Physics II Honors-Elec & Magnetism ....... 3
PH 2230 Electronics for Scientists* .......................... 4
PH 2300 Univ Physics III-Raids & Thermodynamics ...... 2
PH 2400 Univ Physics IV-Waves & Modern Physics ...... 2
PH 3110 Theoretical Mechanics I ............................... 3
PH 3111 Theoretical Mechanics II OR PH 3411 Quantum Physics II OR PH 4211 Electricity and Magnetism II .... 3
PH 3210 Geometrical and Physical Optics ................... 4
PH 3300 Thermodynamics and Statistical Mechanics** ...... 3
PH 3410 Quantum Physics I ...................................... 3
PH 3480 Modern Physics Laboratory .......................... 2
PH 4010 Senior Physics Colloquium I ......................... 1
PH 4011 Senior Physics Colloquium II ......................... 1
PH 4050 Qualitative Methods in Physics ..................... 1
PH 4080 Senior Research I ....................................... 3
PH 4081 Senior Research II ..................................... 3
PH 4210 Electricity and Magnetism I ......................... 3
Choose 6 credits from the following:
MA 4515 Intro Partial Diff Equations, MA 4520 Integral Trans & Series Meth, MA 4525 Applied Vector & Tensor Math, MA 4635 Numerical Meth for Integral Equations, CS 2911 Intro to Numerical Methods with Fortran

** General Education Requirements—28 credits
- Core ................................................................. 13
  UN 1001 Perspectives on Inquiry ................................... 3
  UN 1002 World Cultures ......................................... 3
  UN 2001 Revisions ................................................ 3
  UN 2002 Institutions ............................................. 3
- Note: Two semesters of a single modern language (6 cr) in addition to UN 1003 World Cultures Activities (1 cr) can substitute for UN 1002.

** Distribution courses ............................................ 15
Students must take two courses each from two different lists, one that has World Cultures as a prerequisite and one that has Institutions as a prerequisite. The fifth course can come from any list. See the General Education section for specific lists and allowed courses.

** Science/Math—Satisfied by major requirements above.

** Co-Curricular Activities—3 units
Currently only PE classes qualify; units are required for graduation, but are not included in the calculation of the GPA, or in the overall credits required for the degree.

** Applied Physics Model Schedule—example only; actual schedule may vary. Include 3 units of co-curricular activities.

** Calculus Start ................................. 2nd Year Fall
1st Year Fall
PH 1110 ................................................. 4
PH 1111 ................................................. 1
CS 1010 ................................................. 3
MA 1150 OR 1151 ........................................ 4-5
PH 1100H ................................................. 1
UN 1001 ................................................. 3
Total ...................................................... 16-17

1st Year Spring
MA 2150 ................................................. 4
PH 1200H ................................................. 1
PH 2100H ................................................. 3
UN 1002 ................................................. 4
Free Elective ............................................. 4
Total ...................................................... 16

2nd Year Fall
PH 2230* ................................................. 4
MA 2320 ................................................. 2
MA 3150 ................................................. 2
MA 3530 ................................................. 3
PH 2010 ................................................. 1
PH 2011 ................................................. 3
PH 2020 ................................................. 4
UN 2002 OR 2001 ........................................ 4
Total ...................................................... 14

3rd Year Fall
General Ed Distribution ........................................ 3
PH 3110 ................................................. 3
PH 3210 ................................................. 4
PH 3410 ................................................. 3
Application Elective** ...................................... 4
Total ...................................................... 16

3rd Year Spring
General Ed Distribution ........................................ 3
PH 3111 OR 3411** ...................................... 3
PH 3300** ................................................. 3
PH 3480 ................................................. 2
Application Elective** ...................................... 4
Free Elective ............................................. 2 or 5
Total ...................................................... 17

4th Year Fall
General Ed Distribution ........................................ 3
PH 4010 ................................................. 1
PH 4050 ................................................. 3
PH 4080 ................................................. 3
PH 4210 ................................................. 3
Application Elective** ...................................... 4
Elective ...................................................... 1
Total ...................................................... 16

** Physics, BS
SECONDARY EDUCATION—PHYSICS CONCENTRATION
College of Sciences and Arts

Students receiving a degree with teaching certification readily find employment in secondary schools or, if qualified, they may continue with graduate studies in physics or education.

Total Credits Required: 129
major Requirements—64 credits
CH 1110 University Chemistry I .............................. 4
CH 1111 University Chemistry Lab I ......................... 1
CS 1010 Intro to Prog for Engg and Applied Sci .......... 3
MA 1150 Calculus I ........................................... 4
MA 2150 Calculus II .......................................... 4
MA 2320 Elementary Linear Algebra ......................... 2
MA 3150 Multivariable Calculus ................................ 4
MA 3530 Introduction to Differential Equations ........ 3
PH 1100H Introductory Physics Lab I Honors ............ 1
PH 1200H Introductory Physics Lab II Honors ............ 1
PH 1600 Introductory Astronomy ................................ 2
PH 2010 Seminar ............................................. 1
PH 2100H Univ Physics I Honors-Mechanics ............. 3
PH 2200H Univ Physics II Honors-Elec & Magnetism .... 3
PH 2230 Electronics for Scientists* ........................ 4
PH 2300 Univ Physics III-Raids & Thermodynamics .... 2
PH 2400 Univ Physics IV-Waves & Modern Physics .... 2
PH 3110 Theoretical Mechanics I ............................ 3
PH 3210 Geometrical and Physical Optics ................. 4
PH 3300 Thermodynamics and Statistical Mechanics .... 3
PH 3410 Quantum Physics I .................................. 3

Precalculus Start
1st Year Fall
CH 1110 ................................................. 4
CH 1111 ................................................. 1
CS 1010 ................................................. 3
MA 1033 ................................................. 3
PH 1100H ................................................. 1
UN 1001 ................................................. 3
Total ...................................................... 15

1st Year Spring
MA 1150 ................................................. 4
PH 1200H ................................................. 1
UN 1002 ................................................. 4
Free Elective ............................................. 4
Total ...................................................... 13

Remainder of schedule is the same as the Calculus start.
PH 3480 Modern Physics Laboratory ........................................ 2
PH 4010 Senior Physics Colloquium I .................................. 1
PH 4050 Qualitative Methods in Physics ................................ 1
PH 4210 Electricity and Magnetism I ................................... 3

Concentration Requirements—37–49 credits
ED 2100 Instructional Technology ......................................... 2
HU 4150 Literacy in the Content Areas .................................. 4
Courses in each block must be taken concurrently.

Education Early Block
ED 3110 Psychological Foundations of Learning .................. 2
ED 3210 Foundations of Education ...................................... 2
ED 3310 Seminar in Education ........................................... 1
ED 3410 Clinical Experience ............................................ 1

Education Late Block
ED 4810 Methods of Teaching Sci, Math, and CS ................. 4
ED 4910 Directed Teaching ............................................ 12
Approved Education minor ............................................. 9–21

Free Electives—0 credits

General Education Requirements—28 credits
UN 1001 Perspectives on Inquiry ......................................... 3
UN 1002 World Cultures ................................................... 4
UN 2001 Revisions ......................................................... 3
UN 2002 Institutions ....................................................... 3

Note: Two semesters of a single modern language (6 cr) in addition to UN 1003 World Cultures Activities (1 cr) can substitute for UN 1002.

Distribution Courses ...................................................... 15
Students must take two courses each from two different lists, one that has World Cultures as a prerequisite and one that has Institutions as a prerequisite. The fifth course can come from any list. See the General Education section for specific lists and allowed courses. This program requires the following as a distribution course:

PSY 2000 Principles of Psychology ...................................... 3

Science/Math—Satisfy major requirements above.

Co-Curricular Activities—3 units
Currently only PE classes qualify; units are required for graduation, but are not included in the calculation of the GPA, or in the overall credits required for the degree.

Physics Secondary Educ Model Schedule—example only; actual schedule may vary. Include 3 units of co-curricular activities.

1st Year Fall
CH 1110 ................................................................. 4
CH 1111 ................................................................. 1
CS 1010 ................................................................. 3
MA 1150 OR 1151 .................................................. 4–5
PH 1100H ............................................................. 1
UN 1001 ................................................................. 1
Total ................................................................. 16–17

1st Year Spring
PH 1200H ............................................................. 1
PH 2100H ............................................................. 3
MA 2150 ............................................................... 4
MA 1002 ............................................................... 4
PSY 2000 .............................................................. 3
Total ................................................................. 15

2nd Year Fall
MA 2320 ............................................................... 2
MA 3150 ............................................................... 4
PH 1600 ............................................................... 2
PH 2010 ............................................................... 1
PH 2200H ............................................................. 3
PSY 2000 .............................................................. 3
UN 2001 OR 2002 .................................................. 3
Total ................................................................. 18

2nd Year Spring
ED 2100 ............................................................... 2
MA 3530 ............................................................... 3
PH 2230 ............................................................... 4
PH 2300 ............................................................... 2
PH 2400 ............................................................... 2
UN 2002 OR 2001 .................................................. 3
Total ................................................................. 16

3rd Year Fall
PH 3410 ............................................................... 3
PH 3210 ............................................................... 4
PH 3110 ............................................................... 3
Teaching minor ......................................................... 3
Total ................................................................. 16

3rd Year Spring
General Ed Distribution .................................................. 6
PH 3300 ............................................................... 3
PH 3480 ............................................................... 2
Teaching minor ......................................................... 6
Total ................................................................. 17

4th Year Fall
ED 3110 ............................................................... 2
ED 3210 ............................................................... 2
ED 3310 ............................................................... 1
ED 3410 ............................................................... 1
HU 4150 ............................................................... 4
PH 4010 ............................................................... 1
PH 4050 ............................................................... 1
PH 4210 ............................................................... 3
Total ................................................................. 15

4th Year Spring
ED 4810 ............................................................... 4
ED 4910 ............................................................... 12
Total ................................................................. 16

Social Sciences, BS
GENERAL SOCIAL SCIENCES CONCENTRATION
College of Sciences and Arts

A BS degree in the social sciences provides entry-level skills for a variety of other careers including teaching, journalism, business, and communications. In addition, it provides a good background for advanced work in a wide variety of fields, including medicine, education, theology, public administration, social work, research, information management, personnel administration, public relations, and business management.

Total Credits Required: 124

Major Requirements—58 credits
HU 2700 Introduction to Philosophy .................................. 3
MA 2720 Statistical Methods ........................................... 3
Mathematics, science, CS and/or engineering ........................ 13
PSY 2000 Principles of Psychology .................................. 3

SS 1001 Orientation to the Social Sciences ..... 1

SS 2100 World Peoples & Environ OR SS 2200 Prehistory & Archaeology .................................................. 3
SS 2500 American Exp OR SS 2550 Themes in W Cw .................................................. 3
SS 2600 Amer Gov & Politics OR 2700 Intro to Sociology OR 2800 Science, Technology, & Society .................................................. 3

SS 4910 Senior Orientation and Assessment .................................................. 1

SS 4010 Social Science Methods ........................................ 4

Choose 2 of the following: 6
SS 2100 World Peoples & Environments, 2200 Prehistory and Arch, 2500 The Amer Experience OR 2550 Themes in Western Cw, 2600 Amer Government & Politics, 2700 Intro to Sociology, 2800 Science, Tech, & Society

Anthropology/Archaeology .................................................. 3

SS 2100 World Peoples & Environ, 2200 Prehistory and Arch, 3100 Developing Societies, 3200 Historical Arch, 3210 Field Arch, 3220 Arch Lab Methods, 3230 Arch of Industry, 3810 Culture, Sci & Tech, 3890 Indus & the World Econ, 3910 Histories and Cultures, 3920 Topics in Arch, 4100 Amer Indian Political Issues

Geography/Environment .................................................. 3


History .................................................. 3


Sociology .................................................. 3


Political Science/STS .................................................. 3


Concentration Requirements—12–15 credits
Choose 12 credits in a specific area worked out in consultation with advisor. Note: If concentration is anthropology or archaeology or a combination of the two, student must also take SS 3210 (3 cr).

Free Electives—23–26 credits

General Education Requirements—28 credits
Core ......................................................... 13
UN 1001 Perspectives on Inquiry ..................................... 3
UN 1002 World Cultures ............................................. 4
UN 2001 Revisions ................................................... 3

BACCALAUREATE DEGREE REQUIREMENTS 53
**Baccalaureate Degree Requirements**

**Mathematics, science, CS, and/or engineering**
- Mathematics: 4 credits
- Science: 16 credits
- CS or Engineering: 3 credits

**Social Science Requirements**
- Social Science Methods: 4 credits
- Prehistory and Archaeology: 3 credits
- World Peoples & Environments: 3 credits
- Orientation to the Social Sciences: 1 credit
- Principles of Psychology: 3 credits

**College of Sciences and Arts**

- Anthro/Archaeol Elective: 3 credits
- UN 2002 Institutions: 3 credits
- SS 4010: 4 credits
- SS 2200: 3 credits
- SS 2100: 3 credits
- UN 1001: 3 credits
- Lab Science Requirement: 4 credits
- Total: 14 credits

**DISTRIBUTION COURSES**
- Students must take two courses each from two different lists, one that has World Cultures as a prerequisite and one that has Institutions as a prerequisite. The fifth course can come from any list. See the General Education section for specific lists and allowed courses. Program requires the following as a distribution course:
  - EC 2000 Principles of Economics
  - Science/Math—Satisfied by major requirements above.

**Co-Curricular Activities—3 units**
Currently only PE classes qualify; units are required for graduation, but are not included in the calculation of the GPA, or in the overall credits required for the degree.

**General Social Sciences Model Schedule**—example only; actual schedule may vary. Include 3 units of co-curricular activities.

<table>
<thead>
<tr>
<th>1st Year Fall</th>
<th>1st Year Spring</th>
<th>2nd Year Fall</th>
<th>2nd Year Spring</th>
<th>3rd Year Fall</th>
<th>3rd Year Spring</th>
<th>4th Year Fall</th>
<th>4th Year Spring</th>
<th>Total</th>
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<tbody>
<tr>
<td>SS 1001</td>
<td>SS 2550</td>
<td>SS 2500</td>
<td>EC 2000</td>
<td>SS 4010</td>
<td>SS 2200</td>
<td>SS 2600</td>
<td>SS 2700</td>
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</tr>
<tr>
<td>SS 2100</td>
<td>UN 1001</td>
<td>HU 2700</td>
<td>MA 2720</td>
<td>SS 4910</td>
<td>UN 1002</td>
<td>UN 1002</td>
<td>UN 2002</td>
<td></td>
</tr>
<tr>
<td>PSY 2000</td>
<td>CS Requirement</td>
<td>SS 2700</td>
<td>Social Science</td>
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<tr>
<td>UN 1001</td>
<td>Geography/Environ Elective</td>
<td>SS Elective</td>
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<tr>
<td>Lab Science Requirement</td>
<td>MA Requirement</td>
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<td>15</td>
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</tbody>
</table>

**Concentration Requirements—28 credits**
- SS 1002 Orientation to Legal Careers: 3 credits
- SS 2600 American Government & Politics: 3 credits
- SS 3610 International Law: 3 credits
- SS 3630 Environmental Policy and Politics: 3 credits
- SS 4100 American Indian Political Issues: 3 credits

**Nondepartmental requirements**
- Group A: Choose 4 courses
- Group B: Choose 1 course

**General Education Requirements—28 credits**
- Note: Two semesters of a single modern language (6 cr) in addition to UN 1003 World Cultures Activities (1 cr) can substitute for UN 1002.

**Free Electives—16 credits**

**Social Sciences, BS**

**PRE-LAW CONCENTRATION**

*College of Sciences and Arts*

**Total Credits Required: 124**

**Major Requirements—52 credits**
- PSY 2000 Principles of Psychology: 3 credits
- SS 1001 Orientation to the Social Sciences: 3 credits
- SS 2100 World Peoples & Environments: 3 credits
- SS 2200 Prehistory and Archaeology: 3 credits
- SS 2500 The American Experience: 3 credits
- SS 2550 Themes in Western Civilization: 3 credits
- SS 2700 Introduction to Sociology: 3 credits
- SS 2800 Science, Technology, & Society: 3 credits
- SS 4010 Social Science Methods: 4 credits
- SS 4910 Senior Orientation and Assessment: 1 credit
- SS electives: 9 credits
- Mathematics, science, CS, and/or engineering: 16 credits
- At least one course in mathematics and one in laboratory science

**DISTRIBUTION COURSES**
- Concentration Requirements—28 credits
- Social Science Elective: 3 credits
- Core: 13 credits
- General Ed Distribution: 9 credits
- Concentration Elective-Legal Skill: 3 credits
- General Ed Distribution: 3 credits
- Core: 13 credits
- Concentration Elective-Legal Skill: 3 credits
- General Ed Distribution: 3 credits
- Total: 15 credits

**Co-Curricular Activities—3 units**
Currently only PE classes qualify; units are required for graduation, but are not included in the calculation of the GPA, or in the overall credits required for the degree.

**Pre-Law Model Schedule**—example only; actual schedule may vary. Include 3 units of co-curricular activities.

<table>
<thead>
<tr>
<th>1st Year Fall</th>
<th>1st Year Spring</th>
<th>2nd Year Fall</th>
<th>2nd Year Spring</th>
<th>3rd Year Fall</th>
<th>3rd Year Spring</th>
<th>4th Year Fall</th>
<th>4th Year Spring</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>SS 1001</td>
<td>SS 2600</td>
<td>SS 2700</td>
<td>EC 2000</td>
<td>SS 4010</td>
<td>SS 2200</td>
<td>SS 2550</td>
<td>SS 2500</td>
<td></td>
</tr>
<tr>
<td>SS 2100</td>
<td>UN 1001</td>
<td>UN 1002</td>
<td>HU 2700</td>
<td>SS 4910</td>
<td>UN 1002</td>
<td>UN 1002</td>
<td>HU 2700</td>
<td></td>
</tr>
<tr>
<td>PSY 2000</td>
<td>MA Requirement</td>
<td>SS 2700</td>
<td>SS Elective</td>
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</tr>
<tr>
<td>UN 1001</td>
<td>Geography/Environ Elective</td>
<td>SS Elective</td>
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</tr>
<tr>
<td>Lab Science Requirement</td>
<td>MA Requirement</td>
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<td>18</td>
</tr>
</tbody>
</table>

**General Education Requirements—28 credits**
- Note: Two semesters of a single modern language (6 cr) in addition to UN 1003 World Cultures Activities (1 cr) can substitute for UN 1002.

**DISTRIBUTION COURSES**
- Concentration Requirements—28 credits
- Social Science Elective: 3 credits
- Concentration Elective-Legal Skill: 3 credits
- General Ed Distribution: 9 credits
- Concentration Elective-Legal Skill: 3 credits
- General Ed Distribution: 3 credits
- Total: 15 credits
### Social Sciences, BS

**SECONDARY EDUCATION—SOCIAL STUDIES CONCENTRATION**

**College of Sciences and Arts**

**Total Credits Required: 128**

**Major Requirements—60–61 credits**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>EC elective</td>
<td>3</td>
</tr>
<tr>
<td>PSY 2000 Principles of Psychology</td>
<td>3</td>
</tr>
<tr>
<td>SS elective</td>
<td>3</td>
</tr>
<tr>
<td>SS 1001 Orientation to the Social Sciences</td>
<td>1</td>
</tr>
<tr>
<td>SS 2500 The American Experience</td>
<td>3</td>
</tr>
<tr>
<td>SS 2600 American Government &amp; Politics</td>
<td>3</td>
</tr>
<tr>
<td>SS 2700 Introduction to Sociology</td>
<td>3</td>
</tr>
<tr>
<td>SS 3500 Modern American History</td>
<td>3</td>
</tr>
<tr>
<td>SS 3540 History of Michigan</td>
<td>3</td>
</tr>
<tr>
<td>SS 4910 Senior Orientation and Assessment</td>
<td>1</td>
</tr>
<tr>
<td>SS 4010 Social Science Methods OR SS 4500 Historiography</td>
<td>4–3</td>
</tr>
</tbody>
</table>

**Choose 1 of the following:**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>SS 2590 Themes in Western Civilization, 3550 Europe to 1650, 3551 Europe in the Modern Era, 3532 Renaissance &amp; Reformation, 3580 Technology &amp; Western Civ</td>
<td>3</td>
</tr>
</tbody>
</table>

**Choose 1 of the following:**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>SS 3600 American Foreign Policy, 3610 International Law, 3630 Environmental Policy &amp; Politics, 3800 Energy Technology and Policy</td>
<td>3</td>
</tr>
</tbody>
</table>

**Choose 1 of the following:**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>SS 3710 Social Problems, 3740 Sociology of Family, 3750 Social Inequality, 3910 Histories and Cultures, 4100 Amer Indian Political Issues; HU 2520 Cultural Diversity in Amer Lit, PSY 3070 Cross-Cultural Psychology</td>
<td>3</td>
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</tbody>
</table>

**Choose 2 of the following:**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>SS 2100 World Peoples &amp; Environments, 3300 Environmental Problems, 3410 World Resources &amp; Development Mathematics, science, CS, and/or engineering</td>
<td>6</td>
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</tbody>
</table>

**Concentration Requirements*—32 credits**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
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<tbody>
<tr>
<td>ED 2020 Field Study in Education: Secondary School</td>
<td>1</td>
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<tr>
<td>ED 2100 Instructional Technology</td>
<td>2</td>
</tr>
<tr>
<td>FA 2090 Speech Communication</td>
<td>3</td>
</tr>
<tr>
<td>HU 4150 Literacy in the Content Areas</td>
<td>4</td>
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</table>

**EDUCATION EARLY BLOCK**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
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<tbody>
<tr>
<td>ED 3110 Psychological Foundations of Learning</td>
<td>2</td>
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<tr>
<td>ED 3210 Foundations of Education</td>
<td>2</td>
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<tr>
<td>ED 3310 Seminar in Education</td>
<td>1</td>
</tr>
<tr>
<td>ED 3410 Clinical Experience</td>
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**EDUCATION LATE BLOCK**

<table>
<thead>
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<th>Course</th>
<th>Credits</th>
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<tbody>
<tr>
<td>ED 4820 Methods of Teaching Social Studies</td>
<td>4</td>
</tr>
<tr>
<td>ED 4910 Directed Teaching</td>
<td>12</td>
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</table>

**Free Electives—7–8 credits**

**Education**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>UN 1001 Perspectives on Inquiry</td>
<td>3</td>
</tr>
<tr>
<td>UN 1002 World Cultures</td>
<td>4</td>
</tr>
<tr>
<td>UN 2001 Revisions</td>
<td>3</td>
</tr>
<tr>
<td>UN 2002 Institutions</td>
<td>3</td>
</tr>
</tbody>
</table>

**Note:** Two semesters of a single modern language (6 cr) in addition to UN 1003 World Cultures Activities (1 cr) can substitute for UN 1002.

**Distribution Courses**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Students must take two courses each from two different lists, one that has World Cultures as a prerequisite and one that has Institutions as a prerequisite. The fifth course can come from any list. See the General Education section for specific lists and allowed courses. This program requires the following as a distribution course:</td>
<td>15</td>
</tr>
<tr>
<td>EC 2000 Principles of Economics</td>
<td>3</td>
</tr>
</tbody>
</table>

**Science/Math—Satisfied by major requirements above.**

**Co-Curricular Activities—3 units**

Currently only PC classes qualify; units are required for graduation, but are not included in the calculation of the GPA, or in the overall credits required for the degree.

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### BACCALAUREATE DEGREE REQUIREMENTS 55

**Social Studies Secondary Educ Model Schedule—example only; actual schedule may vary. Include 3 units of co-curricular activities.**

**1st Year Fall**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
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<tbody>
<tr>
<td>SS 1001</td>
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<td>SS 2100</td>
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<td>SS 2700</td>
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</tr>
<tr>
<td>PSY 2000</td>
<td>3</td>
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<tr>
<td>UN 1001</td>
<td>3</td>
</tr>
<tr>
<td>Lab Science Requirement</td>
<td>4</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>17</strong></td>
</tr>
</tbody>
</table>

**1st Year Spring**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>SS 2500</td>
<td>3</td>
</tr>
<tr>
<td>SS 2600</td>
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</tr>
<tr>
<td>UN 1002</td>
<td>4</td>
</tr>
<tr>
<td>Lab Science Requirement</td>
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<td><strong>Total</strong></td>
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**2nd Year Fall**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ED 2020</td>
<td>1</td>
</tr>
<tr>
<td>SS 2550</td>
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<tr>
<td>UN 2001</td>
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<td>CS Requirement</td>
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**2nd Year Spring**

<table>
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<tr>
<th>Course</th>
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<tbody>
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<td>SS 3600</td>
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<tr>
<td>SS 3610</td>
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<tr>
<td>SS 4500</td>
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<td><strong>Total</strong></td>
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**3rd Year Fall**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
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<tbody>
<tr>
<td>ED 2100</td>
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<tr>
<td>ED 3110</td>
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</tr>
<tr>
<td>ED 3210</td>
<td>2</td>
</tr>
<tr>
<td>ED 3310</td>
<td>1</td>
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<td>ED 3410</td>
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<tr>
<td>SS 3410</td>
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<tr>
<td>SS 3610</td>
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<td>Free Elective</td>
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<td><strong>Total</strong></td>
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**3rd Year Spring**

<table>
<thead>
<tr>
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<th>Credits</th>
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<tbody>
<tr>
<td>General Ed Distribution</td>
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<td>SS 3540</td>
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<tr>
<td>SS Elective</td>
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<tr>
<td>EC Elective</td>
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</tr>
<tr>
<td>Free Elective</td>
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<td><strong>Total</strong></td>
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**4th Year Fall**

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<th>Course</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>General Ed Distribution</td>
<td>3</td>
</tr>
<tr>
<td>HU 4150</td>
<td>4</td>
</tr>
<tr>
<td>SS 3750</td>
<td>3</td>
</tr>
<tr>
<td>SS 4500</td>
<td>3</td>
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<tr>
<td><strong>Total</strong></td>
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</table>

**4th Year Spring**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ED 4820</td>
<td>4</td>
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<tr>
<td>ED 4910</td>
<td>12</td>
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<tr>
<td>SS 4910</td>
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<tr>
<td><strong>Total</strong></td>
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</tr>
</tbody>
</table>

*Students must also complete a teaching minor or around 20 hours in a science, general science, or mathematics.*

---

**STC—Scientific & Technical Comm, BA**

**College of Sciences and Arts**

Today, individuals are needed who can translate technical information into easy-to-understand language. Scientific and technical communicators write documentation for computer software and user manuals for cars and appliances; produce promotional videos for products and services; and prepare scripts for radio, television, and slide presentations. Michigan Tech's STC program is the largest of its kind in the nation. Students get practical experience by completing projects for university, corporate, or government clients. You will get a strong background in a technical field while developing your communication skills. Employers of STC graduates include Texas Instruments, Unisys, Dow Chemical, IBM, General Motors, and Phanes Press.

**Total Credits Required: 128**

**Major Requirements—67 credits**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>HU 2600 Intro to Scientific and Technical Comm</td>
<td>3</td>
</tr>
<tr>
<td>HU 2644 Computer Applications in Communication</td>
<td>3</td>
</tr>
<tr>
<td>HU 2830 Intro to Speech Communication</td>
<td>3</td>
</tr>
<tr>
<td>HU 3120 Technical and Scientific Communication</td>
<td>3</td>
</tr>
<tr>
<td>HU 3695 Grammar and Usage in Society</td>
<td>3</td>
</tr>
<tr>
<td>Project OR Co-op</td>
<td>3</td>
</tr>
<tr>
<td>HU 4634 Adv Prac in Tech Comm OR UN 3003 Co-op Lab Tech Elec</td>
<td>3</td>
</tr>
</tbody>
</table>

**Take at least 2 courses in each of the following areas; you must exceed credit minimum in some areas to reach the required 33 credits.**

**MEDIA**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>HU 2631 Fund of Photog, 2645 Graphic and Info Design, 2650 Intro to Web Site Des, 3630 Publ &amp; Info Management, 3634 TV Prod I, 3635 TV Prod II, 3642 Intro to Multimedia, 4642 Spec Topics in Adv Media</td>
<td>6–12</td>
</tr>
</tbody>
</table>
### Distribution Courses

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Credits</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Ed Distribution</td>
<td></td>
<td></td>
</tr>
<tr>
<td>UN 1001 Perspectives on Inquiry</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>UN 1003 World Cultures</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Modern Language</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>UN 2001 Revisions</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>UN 2002 Institutions</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>World Cultures Activity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Distribution Courses</td>
<td>15</td>
<td></td>
</tr>
</tbody>
</table>

**Total Credits Required:** 128

### Concentration Requirements—24 credits

- Create, in consultation with advisor and with advisor's permission, a concentration (24 cr), which is any collection of courses that can be shown to contribute to the student's expertise in one area. Courses can be drawn from more than one department and may include humanities courses.
- Earn a Certificate in Modern Language and Area Study.
- Take a minor and supplement it with extra courses to add up to 24 cr. The minor must include a minimum of 16 cr and must be from a field outside STC, but it may be one offered by the humanities department. The minor alone will not meet this requirement.
- Earn a Certificate in Media or in Writing or both. These certificates require 21 cr, but 9 cr from each of these certificates may count toward the major requirements for this degree.

### Free Electives—6 credits

**General Education Requirements—31 credits**

<table>
<thead>
<tr>
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<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>UN 1001 Perspectives on Inquiry</td>
<td>3</td>
</tr>
<tr>
<td>UN 1003 World Cultures</td>
<td>3</td>
</tr>
<tr>
<td>Modern Language</td>
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</tr>
<tr>
<td>UN 2001 Revisions</td>
<td>3</td>
</tr>
<tr>
<td>UN 2002 Institutions</td>
<td>3</td>
</tr>
<tr>
<td>World Cultures Activity</td>
<td>15</td>
</tr>
</tbody>
</table>

**Total Credits Required:** 128

### Science/Math—Satisfied by major requirements above.

### Co-Curricular Activities—3 units

- Science, Mathematics, and CS at least one semester of lab sciences, one computer programming course, and at least one calculus course

### STC—Scientific & Technical Comm, BS

**Total Credits Required:** 128

### Major Requirements—67 credits

- HU 2600 Intro to Scientific and Technical Comm
- HU 2644 Computer Applications in Communication
- HU 2830 Intro to Speech Communication
- HU 5120 Technical and Scientific Communication
- HU 3605 Grammar and Usage in Society
- Project CR Co-op

**Total Credits Required:** 128

### Concentration Elective—3 credits

**Total Credits Required:** 128

### 2nd Year Fall

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Ed Distribution</td>
<td>3</td>
</tr>
<tr>
<td>HU 2600</td>
<td>3</td>
</tr>
<tr>
<td>UN 2001</td>
<td>3</td>
</tr>
<tr>
<td>CS Requirement</td>
<td>3</td>
</tr>
<tr>
<td>Media Requirement</td>
<td>3</td>
</tr>
<tr>
<td>Written/Oral Comm Req</td>
<td>3</td>
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<tr>
<td>Total</td>
<td>18</td>
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</table>

**Total Credits Required:** 128

### 3rd Year Fall

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Ed Distribution</td>
<td>3</td>
</tr>
<tr>
<td>HU 2644</td>
<td>3</td>
</tr>
<tr>
<td>UN 2002</td>
<td>3</td>
</tr>
<tr>
<td>Comm/Linguistics/Phet Req</td>
<td>3</td>
</tr>
<tr>
<td>Concentration Elective</td>
<td>3</td>
</tr>
<tr>
<td>History/Phil of Sci and Tech Req</td>
<td>3</td>
</tr>
<tr>
<td>Written/Oral Comm Req</td>
<td>3</td>
</tr>
<tr>
<td>Total</td>
<td>18</td>
</tr>
</tbody>
</table>

**Total Credits Required:** 128

### 4th Year Fall

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Ed Distribution</td>
<td>3</td>
</tr>
<tr>
<td>HU 2600</td>
<td>3</td>
</tr>
<tr>
<td>UN 2001</td>
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<tr>
<td>CS Requirement</td>
<td>3</td>
</tr>
<tr>
<td>Media Requirement</td>
<td>3</td>
</tr>
<tr>
<td>Written/Oral Comm Req</td>
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</tr>
<tr>
<td>Total</td>
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</tr>
</tbody>
</table>

**Total Credits Required:** 128

### STC—Scientific & Technical Comm, BS

**College of Sciences and Arts**

**Total Credits Required:** 128

### Major Requirements—67 credits

- HU 2600 Intro to Scientific and Technical Comm
- HU 2644 Computer Applications in Communication
- HU 2830 Intro to Speech Communication
- HU 5120 Technical and Scientific Communication
- HU 3605 Grammar and Usage in Society
- Project CR Co-op

**Total Credits Required:** 128
Concentration Requirements—24 credits

Students create, in consultation with advisor and with advisor’s permission, a concentration, which is any collection of courses totaling 24 credits that can be shown to contribute to the student’s expertise in one area. Courses can be drawn from more than one department with advisor’s permission and can be drawn from any discipline other than humanities that grants the BS.

Free Electives—9 credits

General Education Requirements—28 credits

<table>
<thead>
<tr>
<th>Course</th>
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<tbody>
<tr>
<td>UN 1001 Perspectives on Inquiry</td>
<td>3</td>
</tr>
<tr>
<td>UN 1002 World Cultures</td>
<td>4</td>
</tr>
<tr>
<td>UN 2001 Revisions</td>
<td>3</td>
</tr>
<tr>
<td>UN 2002 Institutions</td>
<td>3</td>
</tr>
</tbody>
</table>

Note: Two semesters of a single modern language (6 cr) in addition to UN 1003 World Cultures Activities (1 cr) can substitute for UN 1002.

Distribution Courses—15 credits

Students must take two courses each from two different lists, one that has World Cultures as a prerequisite and one that has Institutions as a prerequisite. The fifth course can come from any list. See the General Education section for specific lists and allowed courses.

S/SCIENCE/MATH—Satisfied by major requirements above.

Co-Curricular Activities—3 units

Current only PE classes qualify; units are required for graduation, but are not included in the calculation of the GPA, or in the overall credits required for the degree.

STC (BS) Model Schedule—example only; actual schedule may vary. Include 3 units of co-curricular activities.

1st Year Fall

<table>
<thead>
<tr>
<th>Course</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>SU 1100 Introduction to Surveying and Mapping</td>
<td>2</td>
</tr>
<tr>
<td>CET 1100 Intro to Computing and Technical Drawing</td>
<td>3</td>
</tr>
<tr>
<td>PH 2100 University Physics I—Mechanics</td>
<td>3</td>
</tr>
<tr>
<td>PH 2200 University Physics II—Electricity &amp; Magnetics</td>
<td>3</td>
</tr>
<tr>
<td>SU 2110 Surveying Fundamentals</td>
<td>3</td>
</tr>
<tr>
<td>SU 2112 Surveying Fundamentals Laboratory</td>
<td>2</td>
</tr>
<tr>
<td>SU 2220 Route and Construction Surveying</td>
<td>3</td>
</tr>
<tr>
<td>SU 2240 Real Estate Law</td>
<td>3</td>
</tr>
<tr>
<td>SU 2310 Surveying Field Practice I</td>
<td>6</td>
</tr>
<tr>
<td>SU 2320 Surveying Field Practice II</td>
<td>6</td>
</tr>
<tr>
<td>SU 3100 Spatial Data Collection and Mapping</td>
<td>2</td>
</tr>
<tr>
<td>SU 3150 Principles of Geodesy</td>
<td>4</td>
</tr>
<tr>
<td>SU 3180 Boundary Surveying Principles</td>
<td>3</td>
</tr>
<tr>
<td>SU 3200 Photogrammetry</td>
<td>3</td>
</tr>
<tr>
<td>SU 3250 Survey Measurements and Adjustments</td>
<td>3</td>
</tr>
<tr>
<td>SU 3280 Land Divisions and Development</td>
<td>3</td>
</tr>
<tr>
<td>SU 4100 Advanced Surveying Techniques</td>
<td>3</td>
</tr>
<tr>
<td>SU 4200 Intro to Geographic Information Systems</td>
<td>3</td>
</tr>
<tr>
<td>SU 4250 Professional Practice: Surveying</td>
<td>3</td>
</tr>
<tr>
<td>TRR 1115 Dendrology</td>
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</table>

Total Credits Required: 129

Major Requirements—101 credits

<table>
<thead>
<tr>
<th>Course</th>
<th>Units</th>
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<tbody>
<tr>
<td>CET 1000 Public Speaking and Group Leadership</td>
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</tr>
<tr>
<td>CET 1100 Intro to Computing and Technical Drawing</td>
<td>3</td>
</tr>
<tr>
<td>CET 2100 Civil/Surveying Software</td>
<td>3</td>
</tr>
<tr>
<td>CET 2251 Soils in Construction</td>
<td>4</td>
</tr>
<tr>
<td>CET 2265 Construction Planning, Sched and Estim</td>
<td>3</td>
</tr>
<tr>
<td>CET 3252 Water and Wastewater Technology</td>
<td>3</td>
</tr>
<tr>
<td>CS 1030 Intro to Engg &amp; Scientific Computing</td>
<td>1</td>
</tr>
<tr>
<td>CS 1030 Introductory Physics Lab I</td>
<td>3</td>
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<tr>
<td>CS 1030 Introductory Physics Lab II</td>
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<tr>
<td>PH 2100 University Physics I—Mechanics</td>
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<tr>
<td>PH 2200 University Physics II—Electricity &amp; Magnetics</td>
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<tr>
<td>SU 1100 Introduction to Surveying and Mapping</td>
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<tr>
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<td>SU 2110 Surveying Fundamentals Laboratory</td>
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<td>3</td>
</tr>
<tr>
<td>TRR 1115 Dendrology</td>
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</tbody>
</table>

Concentration Requirements—0 credits

Free Electives—0 credits

General Education Requirements—26 credits

<table>
<thead>
<tr>
<th>Course</th>
<th>Units</th>
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</thead>
<tbody>
<tr>
<td>UN 1001 Perspectives on Inquiry</td>
<td>13</td>
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<tr>
<td>UN 1002 World Cultures</td>
<td>3</td>
</tr>
<tr>
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<td>3</td>
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<td>UN 2001 Revisions</td>
<td>3</td>
</tr>
<tr>
<td>UN 2002 Institutions</td>
<td>3</td>
</tr>
</tbody>
</table>

Note: Two semesters of a single modern language (6 cr) in addition to UN 1003 World Cultures Activities (1 cr) can substitute for UN 1002.

Surveying, BS

School of Technology

Surveying deals with measurements and the location of precise positions on or near the surface of the earth. MTU offers one of two BS degree programs in surveying in the Midwest. This accredited program is the initial step in attaining licensure as a professional surveyor. Graduates are eligible to sit for the National Fundamentals of Surveying examination. Professional surveyors perform boundary surveys and create subdivision plats. In some states they are the only persons also authorized to perform these services. In addition, they are often involved in various land development projects, topographic mapping, geographic information systems, forensic surveys, geodetic surveys, surveys to collect engineering design data, as well as the take-out of construction projects. Graduates also work in state, federal, and private organizations that do not require a license or go on to graduate study in surveying and mapping, geodesy, photogrammetry, remote sensing, geographic information systems, as well as advanced studies in urban planning and law. The degree can also be used to prepare for entry into construction management, real estate sales and appraisal, and title insurance.

Total Credits Required: 129

Major Requirements—101 credits

<table>
<thead>
<tr>
<th>Course</th>
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</tr>
</thead>
<tbody>
<tr>
<td>CET 1000 Public Speaking and Group Leadership</td>
<td>1</td>
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</tr>
<tr>
<td>SU 3180 Boundary Surveying Principles</td>
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</tr>
<tr>
<td>SU 3200 Photogrammetry</td>
<td>3</td>
</tr>
<tr>
<td>SU 3250 Survey Measurements and Adjustments</td>
<td>3</td>
</tr>
<tr>
<td>SU 3280 Land Divisions and Development</td>
<td>3</td>
</tr>
<tr>
<td>SU 4100 Advanced Surveying Techniques</td>
<td>3</td>
</tr>
<tr>
<td>SU 4200 Intro to Geographic Information Systems</td>
<td>3</td>
</tr>
<tr>
<td>SU 4250 Professional Practice: Surveying</td>
<td>3</td>
</tr>
<tr>
<td>TRR 1115 Dendrology</td>
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</tr>
</tbody>
</table>

Concentration Requirements—0 credits

Free Electives—0 credits

General Education Requirements—26 credits

<table>
<thead>
<tr>
<th>Course</th>
<th>Units</th>
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<tbody>
<tr>
<td>UN 1001 Perspectives on Inquiry</td>
<td>13</td>
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<tr>
<td>UN 1002 World Cultures</td>
<td>3</td>
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<tr>
<td>UN 1002 World Cultures</td>
<td>3</td>
</tr>
<tr>
<td>UN 2001 Revisions</td>
<td>3</td>
</tr>
<tr>
<td>UN 2002 Institutions</td>
<td>3</td>
</tr>
</tbody>
</table>

Note: Two semesters of a single modern language (6 cr) in addition to UN 1003 World Cultures Activities (1 cr) can substitute for UN 1002.
Students must take two courses each from two different lists, one that has World Cultures as a prerequisite and one that has Institutions as a prerequisite. The fifth course can come from any list. See the General Education section for specific lists and allowed courses. This program requires the following as a distribution course:

GE 2000 Understanding the Earth .......................... 3

Science/Math—Satisfied by major requirements above.

Co-Curricular Activities—3 units
Currently only PE classes qualify; units are required for graduation, but are not included in the calculation of the GPA, or in the overall credits required for the degree.

Surveying Model Schedule—example only; actual schedule may vary. Include 3 units of co-curricular activities.

<table>
<thead>
<tr>
<th>1st Year Fall</th>
<th>3rd Year Fall</th>
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</thead>
<tbody>
<tr>
<td>CET 1000 ............</td>
<td>General Ed Distribution ........ 3</td>
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<tr>
<td>CET 1100 ............</td>
<td>GE 2000 ........... 3</td>
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<tr>
<td>MA 1150 .............</td>
<td>SU 3100 ........... 2</td>
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<tr>
<td>PH 1100 .............</td>
<td>SU 3180 ........... 3</td>
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<tr>
<td>SU 1100 .............</td>
<td>SU 3250 ........... 3</td>
</tr>
<tr>
<td>UN 1001 .............</td>
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<table>
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</thead>
<tbody>
<tr>
<td>CET 2100 ...........</td>
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</tr>
<tr>
<td>MA 2150 ............</td>
<td>CET 2251 ........... 4</td>
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<tr>
<td>PH 1200 .............</td>
<td>SU 3200 ........... 3</td>
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<tr>
<td>PH 2100 .............</td>
<td>SU 3150 ........... 4</td>
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<tr>
<td>UN 1002 .............</td>
<td>SU 3280 ........... 3</td>
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<tbody>
<tr>
<td>MA 2310 ............</td>
<td>General Ed Distribution ........ 3</td>
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<tr>
<td>MA 2320 ............</td>
<td>CET 2265 ........... 3</td>
</tr>
<tr>
<td>PH 2200 .............</td>
<td>HU 3120 ........... 3</td>
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<td>SU 2100 .............</td>
<td>SU 4100 ........... 3</td>
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<tr>
<td>SU 2110 .............</td>
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<tr>
<td>TFR 1115 ............</td>
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<tr>
<td>UN 2001 .............</td>
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<tr>
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<table>
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<tr>
<td>CS 1030 ............</td>
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<tr>
<td>MA 2720 ............</td>
<td>CET 3252 ........... 3</td>
</tr>
<tr>
<td>SU 2220 .............</td>
<td>SU 4200 ........... 3</td>
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<tr>
<td>SU 2240 .............</td>
<td>SU 4250 ........... 3</td>
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<tr>
<td>UN 2002 .............</td>
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<th>2nd Year Summer</th>
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<td>SU 2310 ............</td>
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<tr>
<td>SU 2320 ............</td>
</tr>
<tr>
<td>Total ............ 12</td>
</tr>
</tbody>
</table>
Certificates

Certificates can be obtained concurrently while working toward a degree or can be obtained by part-time students without enrolling in a degree program. All students must, however, comply with the procedures for admission to Michigan Tech. Unless otherwise specified in the certificate, students must maintain a minimum 2.50 average on a 4.0 scale in these courses and must earn at least a C in the class for it to count toward the certificate. For more information, contact the respective department or school.

Design Engineering Certificate (25 cr)
Department of Mechanical Engineering—Engineering Mechanics

The Certificate in Design Engineering prepares BSE students specifically for a career path in design engineering. In addition, it offers nondegree-seeking students the appropriate background to sit for the exam that provides professional credentials in design engineering.

ME-EM 2500 Integrated Design and Manufacturing ..........................4
ME-EM 4405 Intro to Finite Element Methods ...............................3
ME-EM 4991D Solid Modeling ......................................................6
ME-EM 4992D Vehicle Packaging ..................................................3
ME-EM 4993D Design for Manufacturing ......................................3
ME-EM 4900 Senior Design Project I ............................................3
MY 2100 Intro to Materials Science and Engineering ........................3

Industrial Forestry Certificate (25 cr)
SBE and SFWP

The School of Forestry and Wood Products (SFWP) and the School of Business and Economics (SBE) jointly award a Certificate in Industrial Forestry. Business students can use the certificate to obtain a working knowledge of the forestry and wood products industries. Credits earned for the certificate may be applied to BSBA technology core. SFWP students can use the certificate to obtain a working knowledge of business and management.

Business and Economics Requirements—12 cr
BA 2300 Accounting Principles I ...............................................3
BA 4610 Project Management OR BA 4760 Strategic Leadership ........3
EC 2000 Principles of Economics ..............................................3
EC 3400 Econ Decision Analy OR BA 3400 Managerial Finance .......3

Forestry and Wood Products Requirements—13 cr
FW 1035 Wood Anatomy and Properties ....................................4
FW 2098 Mill Tour and Seminar ................................................2
FW 2010 Vegetation of North America ........................................4
FW 2050 Measuring Forest Resources .........................................3

International Business Certificate (24 cr)
School of Business and Economics

This program is intended for any MTU student who plans to pursue a career related to international business.

International Business Core—6 cr
BA 4710 International Management ...........................................3
EC 3100 International Economics .............................................3

Language—6 cr
One year of college study of a single language ...............................6

Electives—12 cr
Group A BUSINESS ELECTIVES (6 cr)
BA 2300 Accounting Prin, BA 2500 Bus Law I, BA 3200 Man of Info Sys, BA
3400 Managerial Fin, BA 3600 Qual Management, BA 3610 Operations Man,
BA 3700 Organiz Behav, BA 3900 Prin of Marketing

GROUP B INTERNATIONAL BUSINESS ELECTIVES (3 cr)
BA 4480 Global Finance, BA 4680 Internat Tech Man BA 4780 International
Business Communication

GROUP C INTERNATIONAL SOCIAL SCIENCE ELECTIVES (3 cr)
SS 2100 World Peoples & Environ, SS 2550 Themes in Western Qv, SS 3100
Developing Societies, SS 3400 Contemp Europe, SS 3410 World Resources &
Dev, SS 3551 Europe in the Mod Era, SS 3610 International Law, SS 3880
Industry & the World Econ, SS 3910 Histories and Cultures, SS 3940 World
Affairs

Media Certificate (21 cr)
Department of Humanities

The Certificate in Media was developed to meet the needs of students in technical communication who wish to develop expertise in media. In addition, the certificate can provide students from other programs an opportunity to supplement their studies with an area of interest in media. The objective is to develop a suitable level of expertise in media and to assure prospective employers that students have mastered the skills necessary to work in entry-level positions in media development. Students must take 21 credits in media for the certificate. Nine may be used to meet requirements in the BA or BS degrees in Scientific and Technical Communication.

Production—15 cr
HU 2631 Fund of Photog, HU 2645 Graphic & Info Design for Communicators,
HU 2650 Intro to Web-Page Design and Maintenance, HU 3630 Pub & Info Man,
HU 3634 TV Prod I, HU 3635 TV Prod II, HU 3642 Intro to Multimedia Dev, HU
4642 Spec Topics in Adv Media Dev (may also count as a Nonproduction course)

Nonproduction—6 cr
HU 3151 Fhet of Everyday Texts, HU 3324 Spec Topics in Visual Media, HU 3701
Phl of Tech, HU 3850 Cult Studies, HU 3860 Popular Culture, HU 3920 Spec
Topics in Ling: Lang and Tech, HU 4703 Issues in Comm Ethics, HU 4820 Modes
of Comm

Mine Environmental Engineering Certificate (20 cr)
Department of Mining Engineering

A minimum grade point average of 2.0 in all courses is required for the certificate. Students will be required to complete a minimum of 20 credits from the following course lists (core + elective). Mining engineering students may double-count up to six credits.

Required Core Courses—12 cr
BA 4590 Environmental Law ....................................................3
MG 2010 Safety in Engineering Practice ......................................1
MG 2020 Intro Mining Engg & Mining Methods .........................3
MG 3030 Project Evaluation & Cost Engg (or equiv) .....................3
MG 4200 Mine Environmental Engineering ...............................2

Elective Courses—18 cr
MG 3300 Mat Handling & Transport, MG 3450 Recyling & Materials Sys
Engg, MG 4980 Spec Topics in Mining Engg (mining environ project), CE 3501
Environ Engg Fund, CE 3502 Environ Monitoring & Meas Anal, CE 3610
Hydrology, CM 3110 Transport/Unit Oper, CM 3120 Transport/Unit Oper, CM
3810 Intro to Unit Oper, EC 4600 Natural Resource/Environ Econ, ENG 3500
Environ Engg for the Environ, RW 3330 Soil Science, RW 4220 Wetlands, RW 4360
Forest Soils & Watershed Man, GE 3850 Geology, GE 4800 Groundwater
Eng, GE 4820 Subsurface Remediation, MY 4500 Particle Tech, MY 4510
Hydrometallurgy, MY 4520 Mineral Process Engineering, SS 3300 Environ
Prob, SS 3630 Environ Policy & Politics
Modern Language and Area Study Certificate (21 cr)

Department of Humanities

Students who qualify for a Certificate in either French, German, or Spanish must complete two years of the same modern language (12 credits) and three area study courses (9 credits): one course from II/1 and one course from II/2. Students may choose the third course from either list II/1 or II/2. Students must have a grade point average of 2.5 or better in all courses required for the certificate.

I. Modern Language—12 cr

6 cr must be from 2000-level or above.

<table>
<thead>
<tr>
<th>Course Title</th>
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<tbody>
<tr>
<td>HU1111 Level I-A Fr Lang &amp; Culture, HU 1221 Level I-A Ger Lang &amp; Culture,</td>
</tr>
<tr>
<td>HU1231 Level I-A Span Lang &amp; Culture, HU1212 Level I-B Fr Lang &amp; Culture,</td>
</tr>
<tr>
<td>HU1222 Level I-B Ger Lang &amp; Culture, HU1232 Level I-B Sp Lang &amp; Culture,</td>
</tr>
<tr>
<td>HU1213 Fr Intensive Sum Workshop, HU1223 Ger Intensive Sum Workshop, HU1233</td>
</tr>
<tr>
<td>Span Intensive Sum Workshop, HU1215 Trans Fr Lang, HU 1225 Trans Ger Lang,</td>
</tr>
<tr>
<td>HU 1235 Trans Span Lang, HU 2211 Level II-A Fr Lang &amp; Culture*, HU2221</td>
</tr>
<tr>
<td>Level II-A Fr Ger Lang &amp; Culture*, HU2231 Level II-A Span Lang &amp; Culture*,</td>
</tr>
<tr>
<td>HU2212 Level II-B Fr Lang &amp; Lit, HU2222 Level II-B Ger Lang &amp; Lit, HU2232</td>
</tr>
<tr>
<td>Level II-B Span Lang &amp; Lit, HU 2215 Level II Fr Comp &amp; Conv, HU2225 Level</td>
</tr>
<tr>
<td>II Ger Comp &amp; Conv, HU2235 Level II Span Comp &amp; Conv</td>
</tr>
</tbody>
</table>

II. Area Study Courses—9 cr

1. ANTHROPOLOGY OR CULTURAL GEOGRAPHY (3 cr)

<table>
<thead>
<tr>
<th>Course Title</th>
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<tbody>
<tr>
<td>BA 4710 International Management, SS 3300 Environ Prob, BA 4780</td>
</tr>
<tr>
<td>International Bus Comm*, SS 3460 Contemp Europe, FW 4520 Tropical</td>
</tr>
<tr>
<td>Forestry, SS 3410 World Resources &amp; Dev, SS 2100 World Peoples &amp; Environ,</td>
</tr>
<tr>
<td>SS 3810 Culture, Sci &amp; Tech, SS 3100 Developing Societies, SS</td>
</tr>
<tr>
<td>3910 Histories and Cultures</td>
</tr>
</tbody>
</table>

2. MODERN LANGUAGE LITERATURE/HUMANITIES (3 cr)

<table>
<thead>
<tr>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>HU 3211 Topics in Fr Lit, HU 3221 Topics in Ger Lit, HU 3231 Topics in Span</td>
</tr>
<tr>
<td>Lit, HU 3212 Fr for Spec Purposes, HU 3222 Ger for Spec Purposes, HU</td>
</tr>
<tr>
<td>3232 Span for Spec Purposes, HU 3282 Topics in Francophone Cultures, HU</td>
</tr>
<tr>
<td>3283 Topics in Germ-Speak Cultures, HU 3284 Topics in Span-Speak Cultures,</td>
</tr>
<tr>
<td>HU 3251 Modern Masters*, HU 4211 Modern Lang Sem I-Fr, HU 3252 Lit in Trans*</td>
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<tr>
<td>*, HU4212 Modern Lang Sem II-Fr, HU3253 Essays of World Cultures, HU 4213</td>
</tr>
<tr>
<td>Modern Lang Sem III-Fr, HU3261 Intercultural Comm, HU4221 Modern Lang Sem</td>
</tr>
<tr>
<td>I-Ger, HU 3504 Novels from World Lit**, HU 4222 Modern Lang Sem II-Ger, HU</td>
</tr>
<tr>
<td>4223 Modern Lang Sem III-Ger, HU 4231 Modern Lang Sem I-Span, HU 4232 Modern</td>
</tr>
<tr>
<td>Lang Sem II-Span, HU 4233 Modern Lang Sem III-Span</td>
</tr>
</tbody>
</table>

* distribution list
** with permission of Certificate Advisor

NOTES: The three area study courses should be related or relevant to the specific modern language. No more than two courses may be taken as pass/fail.

Writing Certificate (21 cr)

Department of Humanities

The Certificate in Writing was developed to meet the needs of students in technical communication who wish to cultivate their talents and skills in writing and who wish to present themselves as specialists in writing and editing. Students from other programs can supplement their studies with extra emphasis in writing. It assures prospective employers that students have mastered the skills necessary to work as technical writers and editors. Students must take 21 semester credits in writing for the certificate. Nine of these credits may be used to meet requirements in the BA or BS in Scientific and Technical Communication.

Choose 21 credits from the following:

<table>
<thead>
<tr>
<th>Course Title</th>
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</thead>
<tbody>
<tr>
<td>HU 2110 Creative Writing, HU 3120 Technical and Scientific Comm, HU 3150</td>
</tr>
<tr>
<td>Reading and Writing, HU 3605 Grammar and Usage in Society, HU 3606 Editing,</td>
</tr>
<tr>
<td>HU 3629 Practical Writing, HU 3621 Intro to Journalism, HU 4110 Adv Creative</td>
</tr>
<tr>
<td>Writing, HU 4130 Special Topics in Rhetoric/Composition, HU 4628 Reading &amp;</td>
</tr>
<tr>
<td>Usability in Technical Comm, HU 4634 Adv Practicum in Scientific and</td>
</tr>
<tr>
<td>Technical Comm, HU 4670 Technical Comm Projects and Internships, HU 4690</td>
</tr>
<tr>
<td>Spec Topics in Technical Comm, HU 4703 Issues in Comm Ethics</td>
</tr>
</tbody>
</table>

Advanced Certificate in Modern Language and Area Study (9 cr)

Department of Humanities

Students who want to earn an Advanced Certificate in Modern Language and Area Study in French, German or Spanish must first complete the requirements for the Certificate in Modern Language and Area Study. In addition, students must earn 9 credits from the following two areas: 3 credits in one Advanced Modern Language Seminar and 6 credits in other approved HU courses on the 3000-level or above. Students must have a grade point average of 2.5 or better in all courses required for the Adv. Certificate.
**Minors**

A minor requires a minimum of 16-credit hours of course work, but the actual number required varies by department. Of the 16 credits required, no more that 6 credits of 1000- or 2000-level courses can count toward a minor. (Some departments may allow more if the total number required for the minor is more than 16.) The minor must include at least 6 hours of 3000- or 4000-level courses. These courses must not be required by the student’s major (except as free elective hours). Students interested in adding a minor to their degree program must consult their academic advisors as well as the minor department.

### Aerospace Studies Minor (18 cr)

**Department of Aerospace Studies**

This minor allows students to study one of our country's major instruments of national power, the United States military. The student will study and apply leadership as it is practiced in civilian and military institutions and develop an understanding of the nature of international conflict; the formation of national security policy; the use of aircraft, spacecraft, and information to create political and military effects; and the development and organization of the United States military forces. This minor is an excellent foundation for students planning a career in the aerospace industry or Department of Defense.

**Required Courses—12 cr**
- AF 3001 Leadership Studies I ........................ 3
- AF 3002 Leadership Studies II ........................ 3
- AF 4001 National Security Affairs I .................. 3
- AF 4002 National Security Affairs II .................. 3

**Elective Courses—6 cr**

Any AFROTC Dept course (not courses listed above; max of 4 credits)

**Additional Electives**
- AR 1001 Today's Army .................................. 1
- AR 1059 Marksmanship Training ....................... 1
- BA 3700 Organizational Behavior ....................... 3
- CE 5406 Airport Planning and Design ................ 3
- HU 3120 Technical and Scientific Communications ..... 3
- SS 3505 Military History of the United States .......... 3
- SS 3600 American Foreign Policy ........................ 3
- SS 3940 World Affairs .................................. 3

### American Studies Minor (18 cr)

**Department of Social Sciences**

A minor in American Studies provides students with a concentration in U.S. history, politics, and social institutions. It draws from the disciplines of history, sociology, political science, anthropology, and literature. A minor in this field offers a perspective on American society that provides students with historical and socio-political depth with which to understand current affairs in the U.S.

**Required Courses—18 cr**

Choose 6 of the following courses:
- HU 3510 The American Novel .......................... 3
- SS 2500 The American Experience ..................... 3
- SS 2600 American Government and Politics .......... 3
- SS 3500 Modern American History .................... 3
- SS 3505 Military History of the United States ........ 3
- SS 3510 History of American Technology ............. 3
- SS 3511 History of Science in America ............... 3
- SS 3515 History of American Architecture ............ 3
- SS 3520 U.S. Environmental History [alternate years] 3
- SS 3530 The Automobile in American .................. 3
- SS 3540 The History of Michigan [alternate years] .... 3
- SS 3541 The Copper Country ............................ 3
- SS 3600 American Foreign Policy [alternate years] .... 3
- SS 3630 Environmental Policy and Politics ............ 3
- SS 3700 Industry and Society .......................... 3

### Astrophysics Minor (16–18 cr)

**Department of Physics**

The astrophysics minor allows students to better understand the universe and includes discussions of black holes, general relativity, cosmic rays, and theories of the universe. In addition, students are exposed to the practical aspects of the measurement tools used, including data and image processing, optics, cosmic ray counting, and radio telescopes.

**Required Courses—11 cr**

- PH 1600 Introductory Astronomy ....................... 2
- PH 2200 Univ Physics II Elec & Magnetism ............ 3
- PH 4610 Stellar Astrophysics .......................... 3
- PH 4620 Galactic Astrophysics ........................ 3

**Elective Courses—7–7 cr**

Choose 4 additional credits (7 cr for Applied Physics majors) from the following:
- EE 4254 Image Processing .............................. 3
- MA 4710 Regression Analysis ......................... 3
- PH 3600 Remote Sensing ................................ 2
- PH 5610 High Energy Astrophysics .................... 2
- PH 5630 Imaging Systems ................................ 2
- PH 5910 Atmospheric Physics ........................... 2
- PH 5920 Scientific Instrument Fabrication .......... 2

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**Art Minor (16 cr)**

**Department of Fine Arts**

The study of art adds breadth to the student's general university experience and depth to the student's studies in science, technology, and engineering through the honing of spatial skills and awareness. Students with a minor in art will have developed their creative and visual skills, will understand the elements and principles of design, will have an understanding of the history of civilization through their study of art, and will have the tools and incentives for life-long learning.

**Required Courses—6 cr**

FA 1150 Drawing I ........................................ 3
FA 3300 Three Dimensional Design ...................... 3

**Elective Courses—10 cr**

Choose 3 credits from the following:
- FA 2150 Drawing II ....................................... 3
- FA 2200 Watermedia I .................................... 3
- FA 2250 Oil Painting I ................................... 3
- FA 2300 Two Dimensional Design ....................... 3

Choose 3 credits from the following:
- FA 3150 Life Drawing ..................................... 3
- FA 3200 Watermedia II .................................... 3
- FA 3250 Oil Painting II ................................... 3
- FA 3333 Sculpture ......................................... 3

Choose 3 credits from the following:
- FA 3300 Art History I .................................... 3
- FA 3340 Art History II .................................... 3

Choose 1 credit from the following:
- FA 4150 Advanced Drawing Studio ...................... 1
- FA 4200 Advanced Watermedia Studio .................. 1
- FA 4250 Advanced Oil Painting Studio ................ 1
- FA 4300 Advanced Sculpture Studio .................... 1
- FA 4970 Final Project* ................................... 1

*Course not available until academic year 2001–02

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**MINOR DEGREE REQUIREMENTS** 61
Biochemistry Minor (18 cr)
Department of Biological Sciences

The courses required for the minor in biochemistry constitute a comprehensive view of the biological sciences. Students may follow either of two tracks. Track A has an emphasis on cellular and genetic organization of living systems, while track B provides an organismal emphasis. Entry to either track would be through prerequisites: either BL 1040 Principles of Biology or BL 2100 Anatomy and Physiology I.

Track A Cellular Organization and Control
Required Courses—6 cr
BL 2000 Principles of Biochemistry ...........................................3
BL 2020 Biochemistry I .............................................................3
BL 2040 Biochemistry II ...........................................................3

Elective Courses—10 cr
Choose one of the following:
BL 2070 Environmental Biochemistry ........................................3
BL 2100 Principles of Biochemistry ...........................................3
BL 2120 Biochemical Techniques I ...........................................3
BL 2140 Molecular Biology Techniques .....................................3

Track B Organismal Interactions
Required Courses—6 cr
BL 2160 Botany ........................................................................4
BL 2170 Zoology .......................................................................4

Elective Courses—10 cr
Choose two of the following:
BL 3190 Ecology ....................................................................4
BL 3400 Principles of Ecology ..................................................4
BL 3490 Tropical Island Biology ..............................................2
BL 4230 Virology .....................................................................3
BL 4740 Introduction to Mycology .........................................4
BL 4820 Biochemical Techniques I ...........................................3

* None of these elective courses are required in any major except CH.

Biological Sciences Minor (16 cr)
Department of Biological Sciences

The courses required for this minor constitute a comprehensive introduction to the properties of biologically important molecules, mechanisms, and processes and provide the student with extensive information as well as practical laboratory experience. Major topics include the chemistry and purification of proteins, enzymes and enzyme kinetics, intermediary metabolism and regulation, bioenergetics, membrane structure and function, mechanisms and regulation of protein, DNA, RNA and polysaccharides and current techniques in gene cloning and protein engineering.

Required Courses—12 cr
BL 2100 Principles of Biochemistry ...........................................3
BL 4010 Biochemistry I .............................................................3
BL 4020 Biochemistry II ...........................................................3
BL 4030 Molecular Biology .........................................................3

Elective Courses—6 cr
Choose two of the following: BL 4040 Environmental Biochemistry ........................................3
BL 4820 Biochemical Techniques I ...........................................3
BL 4840 Molecular Biology Techniques .....................................3

Communication Studies Minor (18 cr)
Department of Humanities

This minor provides focused study of communication practices, tradition, theories, and issues. Students are introduced to major areas of communication studies such as public, interpersonal, organizational, international as well as to philosophy of communication and cultural studies. The program emphasizes communication in multiple contexts and develops communication competencies and critical awareness of communication practices.

Required Courses—12 cr
Choose one of the following prerequisite courses:
HU 2830 Introduction to Speech Communication ..........................3
HU 2860 Communication and Culture ........................................3

Contexts of Communication—choose three of the following:
HU 3820 Interpersonal Communication ...................................3
HU 3830 Organizational Communication ...................................3
HU 3840 Philosophy of Communication .....................................3
HU 3850 Cultural Studies ...........................................................3
HU 3860 Popular Culture ...........................................................3
HU 4820 Modes of Communication ..........................................3
HU 4830 Philosophy of Communication .....................................3
HU 5011 International Communication ......................................3

Elective Courses—6 cr
Choose two of the following OR one from the following and one from Contexts of Communication: only one course may be at the 2000 level.
HU 2910 Language and Mind .....................................................3
HU 2920 Language and Society ................................................3
HU 3860 Popular Culture ...........................................................3
HU 4625 Risk Communication ..................................................3
HU 4703 Issues in Communication Ethics ..................................3
HU 4890 Topics in Communication ..........................................3

Computer Science Minor (16 cr)
Department of Computer Science

The minor in Computer Science provides a solid foundation in computer science through course work in problem solving, programming, data structures, software engineering, and foundations of computation.

Required Courses—6 cr
CS 2321 Foundation I ...............................................................3
CS 2322 Foundation II ..............................................................3

Chemistry Minor (16–18 cr)
Department of Chemistry

Chemistry is a foundation discipline underlying modern developments in material science, biology, medicine, and genetics. As these areas become subject to increased analysis and understanding at the molecular level, chemistry knowledge becomes ever more important. A chemistry minor can be a useful beginning to becoming a competent technology consumer and scientifically literate citizen. The program outlined below provides broad coverage of chemistry topics and affords a strong foundation in chemistry.

Required Courses—8–11 cr
CH 2252 Measurement Science OR CH 2212 Quant Analy ...................3–5
CH 2420 Organic Chemistry .......................................................3
CH 3500 Phys Chem for Env & Life Sci OR CH 3510 Phys Chem I .......2–3

Elective Courses—7–8 cr
Choose a minimum of 7–8 credits from the following:
CH 3520 Physical Chemistry ......................................................3
CH 3531 Physical Chemistry I .....................................................3
CH 3532 Physical Chemistry II ..................................................3
CH 4370 Inorganic Chemistry .....................................................4
CH 4311 Inorganic Chemistry Lab .............................................2
CH 4412 Spectroscopy of Organic Chemistry ...............................3
CH 4610 Intro to Polymer Sci .....................................................3
CH 4620 Polymer Chemistry .....................................................3
CH 4631 Polymer Science Lab ....................................................2
CH 4641 Polymer Chemistry Lab ..............................................2
CH 4710 Chemical Principles in Biology ....................................3

* Only 6 credits of the 8 required count toward the minor.
**Elective Courses—10 cr**
Choose 10 credits from the following:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CS 3141</td>
<td>System Software Project</td>
<td>3</td>
</tr>
<tr>
<td>CS 3421</td>
<td>Computer Architecture</td>
<td>4</td>
</tr>
<tr>
<td>CS 4121</td>
<td>Programming Languages</td>
<td>3</td>
</tr>
<tr>
<td>CS 4311</td>
<td>Introduction to Computational Theory</td>
<td>3</td>
</tr>
<tr>
<td>CS 4321</td>
<td>Introduction to Algorithms</td>
<td>3</td>
</tr>
<tr>
<td>CS 4411</td>
<td>Introduction to Operating Systems</td>
<td>4</td>
</tr>
<tr>
<td>CS 4611</td>
<td>Introduction to Computer Graphics</td>
<td>3</td>
</tr>
</tbody>
</table>

Upon the approval of the Computer Science Undergraduate Committee, other CS 3000- and CS 4000-level courses may be used in satisfying the requirements of the CS minor.

**Earth Sciences Minor (16 cr)**

*Department of Geological Engineering and Sciences*

A sequence of courses designed to give students a general background in the many facets of Geology and Earth Sciences.

**Required Course** — 3 cr
GE 2000 Understanding the Earth OR GE 2100 Environmental Geology . . . . . 3

**Elective Courses—13 cr**
No more than 3 cr of the 2000-level courses below can count toward the minor:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>GE 2000</td>
<td>Understanding the Earth</td>
<td>3</td>
</tr>
<tr>
<td>GE 2100</td>
<td>Environmental Geology</td>
<td>3</td>
</tr>
<tr>
<td>GE 2300</td>
<td>Earth Mat 1: Mineralogy</td>
<td>3</td>
</tr>
<tr>
<td>GE 2310</td>
<td>Earth Mat 2: Rocks &amp; Minerals</td>
<td>3</td>
</tr>
<tr>
<td>GE 2400</td>
<td>Intro to Appl &amp; Env Geophysics</td>
<td>4</td>
</tr>
<tr>
<td>GE 2640</td>
<td>Introduction to Meteorology</td>
<td>3</td>
</tr>
<tr>
<td>GE 2900</td>
<td>Geology of Utah's Natural Parks</td>
<td>3</td>
</tr>
<tr>
<td>GE 3000</td>
<td>Structural Geology</td>
<td>3</td>
</tr>
<tr>
<td>GE 3100</td>
<td>Depositional Systems</td>
<td>4</td>
</tr>
<tr>
<td>GE 3150</td>
<td>Petroleum Geology</td>
<td>3</td>
</tr>
<tr>
<td>GE 3200</td>
<td>Geochemistry</td>
<td>3</td>
</tr>
<tr>
<td>GE 3300</td>
<td>Introduction to Oceanography</td>
<td>3</td>
</tr>
<tr>
<td>GE 3320</td>
<td>Earth History &amp; Paleoecology</td>
<td>3</td>
</tr>
<tr>
<td>GE 3915</td>
<td>Introduction to Field Geology</td>
<td>3</td>
</tr>
<tr>
<td>GE 3920</td>
<td>Geological Field Excursion</td>
<td>1–6</td>
</tr>
<tr>
<td>GE 4100</td>
<td>Geomorphology &amp; Glacial Geo</td>
<td>4</td>
</tr>
<tr>
<td>GE 4150</td>
<td>Natural Hazards</td>
<td>3</td>
</tr>
<tr>
<td>GE 4210</td>
<td>Applied Geochemistry</td>
<td>3</td>
</tr>
<tr>
<td>GE 4300</td>
<td>Igneous &amp; Metamorphic Petrology</td>
<td>4</td>
</tr>
<tr>
<td>GE 4400</td>
<td>Near Surface Geophysics 1</td>
<td>3</td>
</tr>
<tr>
<td>GE 4410</td>
<td>Near Surface Geophysics 2</td>
<td>3</td>
</tr>
<tr>
<td>GE 4500</td>
<td>Plate Tectonics &amp; Global Geophysics</td>
<td>3</td>
</tr>
<tr>
<td>GE 4750</td>
<td>Struc Styles in Petroleum Eng</td>
<td>3</td>
</tr>
<tr>
<td>GE 4760</td>
<td>Engg Eval of Mineral Deposits</td>
<td>3</td>
</tr>
</tbody>
</table>

* GE 2000 is a prerequisite for a number of elective courses. GE 2000 or GE 2100, if not taken as a required course, can be taken as an elective.

**Economics Minor (18 cr)**

*School of Business and Economics*

The Economics minor provides an understanding of how economies function, the foundation needed to examine economic issues associated with business, social, and governmental policies, and an exposure to areas where economics is applied to practical problems.

**Required Courses—9 cr**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>EC 2000</td>
<td>Principles of Economics</td>
<td>3</td>
</tr>
<tr>
<td>EC 3000</td>
<td>Microeconomic Theory</td>
<td>3</td>
</tr>
<tr>
<td>EC 3010</td>
<td>Macroeconomic Theory</td>
<td>3</td>
</tr>
<tr>
<td>EC 4200</td>
<td>Econometrics</td>
<td>3</td>
</tr>
</tbody>
</table>

**Elective Courses—9 cr**
Choose any three upper-division EC courses other than EC 4900. Note: EC courses, other than EC 2000 Principles of Economics, are numbered at the 3000 and 4000 level.

**Electronic Materials Minor (16 cr)**

*Department of Materials Science and Engineering*

Electrical engineers, computer engineers and physicists who plan careers in the electronic materials and device fabrication industries need a sophisticated understanding of materials in order to succeed. Most increases in computer speed, for example, have come from advances in materials processing operations in semiconductor fabrication plants. This minor addresses the needs of non-materials majors planning careers in these fields. The core course work covers the fundamentals of material structures, materials characterization methods, and electronic materials processing and design.

**Required Courses—12 cr**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MY 2100</td>
<td>Intro to Materials Science and Engineering</td>
<td>3</td>
</tr>
<tr>
<td>MY 3200</td>
<td>Materials Characterization I</td>
<td>4</td>
</tr>
<tr>
<td>MY 4700</td>
<td>Electronic Properties of Materials</td>
<td>2</td>
</tr>
<tr>
<td>MY 4710</td>
<td>Materials Science of Electronic Devices</td>
<td>3</td>
</tr>
</tbody>
</table>

**Elective Courses—4 cr**
Choose at least 4 credits from the following:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MY 3100</td>
<td>Materials Processing I</td>
<td>4</td>
</tr>
<tr>
<td>MY 3210</td>
<td>Materials Characterization II</td>
<td>4</td>
</tr>
</tbody>
</table>
Environmental Studies Minor (18 cr)

Department of Social Sciences

A minor in Environmental Studies emphasizes social and political dimensions of environmental issues. It utilizes the disciplines of public policy, sociology, anthropology, history, and ecology to explore the multifaceted aspects of contemporary environmental issues.

Required Courses—18 cr

Choose 6 of the following; at least four should be from Social Sciences:

BA 4790 Ecology and Organizations [alternate years] .................. 3
EC 4600 Natural Resource/Environmental Economics ................. 3
GE 4410 Near Surface Geophysics 2 .................................. 3
GE 4610 Formation Evaluation & Petroleum Engg ....................... 3
GE 4760 Engineering Evaluation of Mineral Deposits .................. 3
GE 4800 Groundwater Engineering .................................. 3
GE 4810 Groundwater Site Investigation ................................ 3
GE 4820 Subsurface Remediation .................................. 3
GE 4900 Geological Engineering Design Project 1 ...................... 3
GE 4910 Geological Engineering Design Project 2 ...................... 3

Elective Courses—6 cr

Choose a minimum of 6 credits from the following:

SS 2200 Prehistory and Archaeology ................................ 3
SS 2500 American Experience .................................. 3
SS 2550 Themes in Western Civilization .............................. 3
SS 3200 Historical Archaeology .................................. 3
SS 3210 Field Archaeology .................................. 3
SS 3220 Archaeology Laboratory Methods ............................ 4
SS 3230 Archaeology of Industry .................................. 3
SS 3500 Modern American History .................................. 3
SS 3505 Military History of the U.S. .................................. 3
SS 3510 History of American Technology .................................. 3
SS 3511 History of Science in America .................................. 3
SS 3515 History of American Architecture .................................. 3
SS 3530 The Automobile in America .................................. 3
SS 3540 The History of Michigan [alternate years] ...................... 3
SS 3541 The Copper Country .................................. 3
SS 3550 Europe to 1650 .................................. 3
SS 3551 Europe in the Modern Era .................................. 3
SS 3552 Renaissance & Reformation [alternate years] ................. 3
SS 3560 History of England I .................................. 3
SS 3561 History of England II .................................. 3
SS 3570 History of Canada .................................. 3
SS 3571 History of Science in America .................................. 3
SS 3580 Technology and Western Cv [alternate years] ................. 3
SS 3910 Histories & Cultures [on demand; w/ approval of SS dept] .... 3
SS 3920 Topics in Archaeology .................................. 3
SS 3950 Topics in American History .................................. 3
SS 4000 Independent Study [readings or research on history topic] .... 1–3
SS 4500 Historiography [alternate years] .................................. 3

Ethics and Philosophy Minor (18 cr)

Department of Humanities

The minor in Ethics and Philosophy enables students to examine value issues in diverse professional and practical contexts such as medicine, communications, engineering, the environment, and politics. Students may also focus on philosophical questions about science and technology, as well as on traditional problems in philosophy. The active cultivation of critical reasoning skills in each of these areas is emphasized.

Required Courses—3 cr

HU 2700 Introduction to Philosophy .................................. 3

Elective Courses—15 cr

Choose at least one course from list A, one from list B, and three courses from either list.

List A: ETHICS AND VALUES

HU 3710 Engineering Ethics .................................. 3
HU 3711 Biomedical Ethics .................................. 3
HU 4700 Topics in Philosophy .................................. 3
HU 4701 Political Philosophy .................................. 3
HU 4702 Environmental Philosophy .................................. 3
HU 4703 Issues in Communication Ethics .............................. 3

List B: ALL OTHER PHILOSOPHY

HU 2701 Logic and Critical Thinking .................................. 3
HU 3700 Philosophy of Science .................................. 3
HU 3701 Philosophy of Technology .................................. 3
HU 4700 Topics in Philosophy .................................. 3
HU 4701 Political Philosophy .................................. 3
HU 4703 Issues in Communication Ethics .............................. 3

Geological Engineering Minor (16 cr)

Department of Geological Engineering and Sciences

Geological conditions are often critical factors influencing infrastructure and resource development projects. The geological conditions affect both the feasibility and design of projects in terms of both economic and public-safety considerations. An aptitude in applying scientific principles and engineering skills to solve problems influenced by geological conditions would be a valuable asset for professionals involved with such projects. A minor in geological engineering would provide a basic set of technical, practical skills in the investigation, assessment, and design of systems pertaining to the earth and its resources (petroleum, minerals, groundwater).

Required Courses—10 cr

GE 2400 Intro to Applied and Environ Geophysics ..................... 4
GE 3800 Earth Mechanics .................................. 3
GE 3850 Geohydrology .................................. 3

Elective Courses—6 cr

Choose a minimum of 6 credits from the following:

GE 3900 Field Geophysics .................................. 5
GE 4400 Near Surface Geophysics 1 .................................. 3
GE 4410 Near Surface Geophysics 2 .................................. 3
GE 4610 Formation Evaluation & Petroleum Engg ....................... 3
GE 4760 Engineering Evaluation of Mineral Deposits .................. 3
GE 4800 Groundwater Engineering .................................. 3
GE 4810 Groundwater Site Investigation ................................ 3
GE 4820 Subsurface Remediation .................................. 3
GE 4900 Geological Engineering Design Project 1 ...................... 3
GE 4910 Geological Engineering Design Project 2 ...................... 3

Historical Studies Minor (18 cr)

Department of Social Sciences

A minor in Historical Studies emphasizes the archaeological and historical perspective on human society. Archaeology exposes students to the unwritten record and to prehistory, an essential component of historical thought. History provides insights on the past through the written record, and analysis of societal change and development.

Required Courses—18 cr

Choose 6 of the following courses:

SS 2200 Prehistory and Archaeology ................................ 3
SS 2500 American Experience .................................. 3
SS 2550 Themes in Western Civilization .............................. 3
SS 3200 Historical Archaeology .................................. 3
SS 3210 Field Archaeology .................................. 3
SS 3220 Archaeology Laboratory Methods ............................ 4
SS 3230 Archaeology of Industry .................................. 3
SS 3500 Modern American History .................................. 3
SS 3505 Military History of the U.S. .................................. 3
SS 3510 History of American Technology .................................. 3
SS 3511 History of Science in America .................................. 3
SS 3515 History of American Architecture .................................. 3
SS 3530 The Automobile in America .................................. 3
SS 3540 The History of Michigan [alternate years] ...................... 3
SS 3541 The Copper Country .................................. 3
SS 3550 Europe to 1650 .................................. 3
SS 3551 Europe in the Modern Era .................................. 3
SS 3552 Renaissance & Reformation [alternate years] ................. 3
SS 3560 History of England I .................................. 3
SS 3561 History of England II .................................. 3
SS 3570 History of Canada .................................. 3
SS 3571 History of Science in America .................................. 3
SS 3580 Technology and Western Cv [alternate years] ................. 3
SS 3910 Histories & Cultures [on demand; w/ approval of SS dept] .... 3
SS 3920 Topics in Archaeology .................................. 3
SS 3950 Topics in American History .................................. 3
SS 4000 Independent Study [readings or research on history topic] .... 1–3
SS 4500 Historiography [alternate years] .................................. 3
International Studies Minor (18 cr)

Department of Social Sciences

A minor in International Studies brings a global and comparative perspective to the study of culture, politics, history, and the environment. The focus is upon histories and cultures of Europe and developing nations. Through study of comparative social systems and of the international dimensions of specific current issues, students will have a foundation for an examination of society and politics in the United States.

Required Courses—18 cr

Choose 6 of the following courses:

- SS 2100 World Peoples and Environments
- SS 2550 Themes in Western Civilization
- SS 3100 Developing Societies [alternate years]
- SS 3300 Environmental Problems
- SS 3400 Contemporary Europe
- SS 3410 World Resources and Dev [alternate years]
- SS 3570 History of Canada
- SS 3580 Technology and Western Cv [alternate years]
- SS 3610 International Law [alternate years]
- SS 3620 International Technology Policy
- SS 3810 Culture, Science, and Tech [alternate years]
- SS 3830 Industry and the World Economy
- SS 3910 Histories & Cultures [on demand; with approval of SS dept]
- SS 3940 World Affairs
- SS 3950 World Problems
- SS 3960 International Experience
- SS 4000 Independent Study [readings/research on a topic concerning comparative history, culture, or politics]

Students may choose only one of the following courses:

- SS 3550 Europe to 1650
- SS 3551 Europe in the Modern Era
- SS 3552 Renaissance & Reformation [alternate years]
- SS 3560 History of England I
- SS 3561 History of England II

Students may choose only one of the following courses:

- FW 4520 Tropical Forests
- HU 3502 World Mythologies
- HU 3504 Novels from World Literature
- HU 3910 Language in the World

Journalism Minor (18 cr)

Department of Humanities

The minor will prepare students majoring in such fields as engineering, sciences, forestry, and business to pursue the journalistic aspects of their chosen fields (e.g., gathering and reporting information) and to be better informed and more critical consumers of the news.

Required Courses—12 cr

- HU 3605 Grammar and Usage in Society
- HU 3621 Introduction to Journalism
- HU 4634 Advanced Practicum in STC
- HU 4703 Issues in Communication Ethics

Elective Courses—6 cr

No more than two chosen from any one list may be at the 2000 level.

Production Courses

Choose at least one of the following—3 cr minimum

- HU 2631 Fundamentals of Photography
- HU 2650 Intro to Web Site Design

Mathematical Sciences Minor (16 cr)

Department of Mathematical Sciences

Students who wish to study mathematics beyond what is required for their major program may complete a minor in the Mathematical Sciences.

Required Courses—6–9 cr

Choose one course from the following:

- MA 1135 Calculus for Life Sciences
- MA 1150 Calculus 1
- MA 1151 Calculus 1 Plus
- MA 1160 Calculus with Technology 1
- MA 1161 Calculus Plus with Technology 1
- MA 2150 Calculus 2
- MA 2160 Calculus with Technology 2

Elective Courses—10 cr

Choose at least 10 credits numbered 3000 or above; 6 of these credits cannot satisfy a requirement for the student's major program, except as free electives.

Theory Core

a. Choose at least one course from the following:

- MA 3210 Introduction to Combinatorics
- MA 3310 Introduction to Abstract Algebra
- MA 3450 Introduction to Real Analysis
- MA 3924 College Geometry with Technology

b. Choose a second course from the above theory core list OR any 4000-level MA course (except MA 4945).

c. Choose any other 3000- or 4000-level MA course.

Note: Students who wish to complete a Teaching Certificate Minor in Mathematics, as part of their certification to teach high school mathematics, should see the entry under Secondary Teacher Certification Minor.

Microbiology Minor (16 cr)

Department of Biological Sciences

The courses within the minor in Microbiology constitute a selection which focus around environmental, ecological, organismal and medical aspects of the field of microbiology. Laboratories are an essential component of many of these courses.

Prerequisite Courses—4–7 cr

- BL 1040 Prin of Bio OR BL 1060 Fund of Bio
- BL 2100 Prin of Biochemistry (for students choosing BL 3310)

Note: At least one of the following—3 cr minimum

- BL 2631 Fundamentals of Photography
- BL 2650 Intro to Web Site Design
Military Arts and Science Minor (17 cr)
Department of Military Science (Army)

Minor not available until academic year 2001–02

Students of any major will greatly benefit in having a Military Arts and Science minor. Leadership, communication, team building, and problem solving are skills required for success in all careers. This minor will complement any major through a series of goal-oriented classes that will enhance the student’s marketability.

Required Courses—13 cr
AR 3001 Small Unit Tactics ............................................. 3
AR 3002 Advanced Military Tactics .................................. 3
AR 4001 Junior Officer Development Seminar ................... 3
AR 4033 Seminar in Leadership ........................................ 3
AR 4010 Battalion Staff Operations .................................. 1

Elective Courses—4 cr
Any Army ROTC Department courses not listed above

Music Minor (16–19 cr)
Department of Fine Arts

A minor in music adds breadth to the student's university experience and provides the student with in-depth experiences and understanding in music. Through studies in theory, appreciation, history, and performance, students will develop their musical abilities and will receive a foundation for music as a serious avocation. The minor allows the student to choose from three areas of focus: general music, music technology, and jazz idiom.

1. General Music Focus (16 cr) Students who complete a minor in general music will demonstrate a basic competency in music theory and history and a broad-based knowledge of various genres.

Required Courses—10 cr
FA 2500 Music Theory I* ............................................. .3
FA 3530 Music Theory II* ............................................ .3
FA 3560 Music History ................................................ .3
FA 4970 Final Project* ................................................ 1

Elective Courses—6 cr
Choose 3 credits from the following:
FA 3550 History of Jazz ................................................ .3
FA 3580 American Musical Theatre ................................ .3
FA 4950 Special Topics in Fine Arts ................................. .3
FA 4960 Special Topics: Workshop ................................. .3
FA 2400 Huskies Pep Band ............................................ .1
FA 2402 Campus Concert Band ..................................... .1
FA 2420 Jazz Lab Band .................................................. .1
FA 3400 Keweenaw Symphony Orchestra ......................... .1
FA 3401 Wind Symphony .............................................. .1
FA 3420 R & D Jazz Band .............................................. .1
FA 3500 Gospel Choir ................................................... .1
FA 3510 Concert Choir .................................................. .1
FA 4400 Chamber Music Seminar .................................. .1

2. Music Technology Focus (16 cr) Students who complete a minor in music technology will gain a basic competency in music theory and history, a facility with MIDI instruments and with music notation and sequencing software.

Required Courses—10 cr
FA 2500 Music Theory I* ............................................. .3
FA 3530 Music Theory II* ............................................ .3
FA 3560 Music History ................................................ .3
FA 4970 Final Project* ................................................ 1
Elective Courses—6 cr
No more than 6 credits of 2000-level courses can count toward the minor.
Choose 3 credits from the following:
FA 2520 Music Appreciation ........................................ 3
FA 3550 History of Jazz ............................................. 3
FA 3830 American Musical Theatre ................................. 3
Choose 3 credits from the following:***
FA 2420 Huskies Pep Band ........................................... 1
FA 4220 R & D Jazz Band ............................................. 1
FA 4240 Jazz Lab Band ............................................... 1
FA 3400 Keweenaw Symphony Orchestra ......................... 1
FA 3401 Wind Symphony ............................................ 1
FA 3420 R & D Jazz Band ............................................. 1
FA 3500 Gospel Choir ................................................ 1
FA 3510 Concert Choir ............................................... 1
FA 4400 Chamber Music Seminar .................................. 1

Required Courses—16 cr
FA 2500 Music Theory I** ........................................... 3
FA 3530 Music Theory III** .......................................... 3
FA 3550 History of Jazz ............................................. 3
FA 4950 Special Topics in Jazz Arranging ................................. 3
FA 4960 Special Topics in Jazz Improvisation ....................... 3
FA 4970 Final Project* .............................................. 1

Elective Courses—3 cr
Choose 3 credits from the following:
FA 2420 Jazz Lab Band ............................................. 1
FA 3420 R & D Jazz Band ............................................. 1
FA 4420 Music Performance: Jazz ............................... 2
* Course not available during academic years 2001-02
** Computer-based course
*** Repetition of a course upon approval by the course instructor.

Physics Minor (16 cr)
Department of Physics
The physics minor provides a broad background in all of the traditional areas of physics designed for those students who seek a firmer foundation in the most fundamental of the sciences. The increased knowledge in physics will benefit students in many different disciplines as they prepare for a life-long career in our ever-changing technological world. Not open to applied physics majors.

Required Courses—16 cr
PH 2100 University Physics I-Mechanics ....................... 3
PH 2200 University Physics II-Bec & Magnetism ............... 3
PHYSICS AT THE 3000-LEVEL AND ABOVE (10 CR MINIMUM)
Of the 10 additional credits, at least 9 must be from courses not required for the student’s major; include at least one of the following:
PH 3110 Theoretical Mechanics I .................................. 3
PH 3410 Quantum Physics I ......................................... 3
PH 4210 Electricity and Magnetism ............................... 3

Plant Biotechnology Minor (16 cr)
School of Forestry & Wood Products and Department of Biological Sciences
This minor provides students an introductory understanding of the field of biotechnology with particular emphasis on plant biotechnology. Students majoring in fields impacted by biotechnologies—business administration, biomedical engineering, environmental engineering, chemical engineering, as well as chemistry and humanities—will benefit from this minor.

Required Courses—9 cr
BL 2100 Principles of Biochemistry .................................. 3
FW 2080 Intro to Plant Biotechnology ............................ 3
FW 4087 Molecular Genetics of Trees ............................. 3

Elective Courses—7 cr
Choose 7 credits minimum from the following:
BL 3210 General Microbiology ..................................... 4
BL 4010 Biochemistry I ............................................ 4
BL 4030 Molecular Biology ......................................... 3
BL 4140 Plant Physiology .......................................... 4
FW 4085 Wood Biotechnology ...................................... 3
FW 4089 Plant Bioinformatics ........................................ 3
FW 4120 Tree Physiology & Genetics .............................. 3
FW 5050 Current Topics in Forest Biotechnology .............. 3

Students are highly recommended to take 1–3 cr of Undergraduate Research (FW 4500 or BL 4000) in addition to the minor to gain hands-on experience. Permission of instructor is required.

Plant Sciences Minor (16 cr)
School of Forestry & Wood Products and Department of Biological Sciences
This minor provides students the opportunity to study and develop an understanding of the plant sciences and their role as a foundation of modern society. Open to all majors.

Required Course—4 cr
BL 2160 Botany ........................................................... 4

Elective Courses—12 cr
Choose at least 6 credits from the following:
BL 4130 Physiology ................................................... 3
BL 4140 Plant Physiology ............................................ 4
BL 4140 Plant Taxonomy ............................................ 4
FW 4087 Molecular Genetics of Trees ............................. 3
FW 4110 Tree Seedling Production & Greenhouse Management .......................................................... 1-4
FW 4520 Tropical Forests ............................................... 3
Select remaining electives from the above list or from the following:
BL 5680 Bryology ....................................................... 4
FW 1035 Wood Anatomy and Properties* ......................... 4
FW 2010 Vegetation of North America* ......................... 4
FW 2080 Intro to Plant Biotechnology* ......................... 3
FW 3020 Forest and Landscape Ecology ........................... 3
FW 4220 Wetlands ....................................................... 4
* Only two-credits total from this course may count toward the minor.

Psychology Minor (18 cr)
Department of Education
This program is designed to help students develop an understanding and appreciation of the lawfulness of human behavior. The psychology minor is designed to expose students to a range of perspectives, methodologies, and content areas. Students will find the minor program in psychology particularly relevant if they are planning to work in industry and business domains, community agencies, medical settings, or other professional areas in which significant interaction with people is required. Students should note that some of the elective courses for a psychology minor might have their own prerequisites.

Required Courses—6 cr
PSY 2000 Principles of Psychology .................................. 3
PSY 4000 Experimental Methods & Statistics .................. 3

Elective Courses—12 cr; 8 cr must be PSY
ED 3110 Educational Psychology .................................... 2
ED 4010 Psychology of Coaching .................................... 3
PSY 2050 History and Systems of Psychology .................. 3
Remote Sensing Minor (16 cr)

Interdisciplinary

Remote Sensing is measurement from a distance, sensing from afar. It uses the whole electromagnetic spectrum and is applied on a huge variety of scales, from microscopic to satellite or astronomical levels. It is used where direct sensing is impossible or difficult. Most of the remote sensing faculty have active research programs that require student workers and this experience is good professional training. The field is highly interdisciplinary and extremely broad and team based, including specialists in atmospheric physics and chemistry, biological and earth sciences, electrical engineering, forestry and ecology, civil, and environmental engineering, oceanography, limnology, image and signal analysis, astronomy and computer sciences. The Remote Sensing Institute has faculty from 9 different departments and has a number of advanced lab facilities as part of a NASA center of excellence.

Required Courses—4 cr

PH 3600 Introduction to Remote Sensing .......................... 2
UN 4000 Remote Sensing Seminar .................................. 1

[Taken for 2 semesters]

Elective Courses—12 cr


Data Management (3–6 cr): CE 5661 GIS Appl, CS 2090 Spec Topics in CS, CS 3621 Intro to Computing with Geometry, CS 4611 Intro to Comp Graphics; FW 3540 Remote Sens & Geographic Info Sys in Nat Res Man; FW 5590 Geographic Info Sys; GE 4160 Subsurface GIS, MA 3730 Survey Methods & Data Analysis, MA 4515 Intro to Partial Diff Equat, MA 4610 Num Linear Alg, MA 4710 Regression Analy, MA 5701 Statistical Math, MA 5741 Multivar Statistical Math, MA 5980 Spec Topics in Math


Independent Study/Senior Research classes (0-3 cr): The classes listed below are used in the remote sensing minor to encourage and give credit for student research and/or independent study. These projects require individual departmental approval and involve supervision by an RSI faculty member. Normally these would be taken within the student's major department. BL 4000 Spec Prob in Bio, CE 4510 Baccalaurate Thesis, CH 4990 Undergrad Res in Chem, CS 4090 Spec topics in CS, EE 4800 Spec Topics in EE, FW 4500 Independent Study, GE 4960 Independent Grad Engg Res, MA 4990 Topics in Math, PH 4080 Sr Res

Secondary Teacher Certification Minors

Department of Education

Biology—21–22 cr*  
BL 1040 (4), BL 2100 (3), BL 2160 (4), BL 2170 (4), BL 2200 (3); Electives (3–4 cr): BL 2010 (3), BL 3190 (3), BL 3210 (3), BL 3400 (4).

Chemistry—22 cr*  
CH 1110 (4), CH 1120 (4), CH 2212 (5), CH 2410 (3), CH 2420 (3), CH 3510 (3)

Computer Science—20 cr*  
(CS 1121 (3), CS 1122 (3), CS 2321 (3), CS 2322 (3); Electives (8–9 cr): CS 3141 (3), CS 3421 (4), CS 4121 (3), CS 4411 (4), CS 4421 (3), CS 4611 (3)

Earth Science—21 cr*  

English—21 cr*  
(HU 3510 CR HU 3541 (3), HU 3512 (3), HU 3540 (3), HU 3525 CR HU 4545 (3), HU 25248 (3), HU 4140 (3), (HU 2830 CR FA 2090 (3))

Mathematics—22 cr*  
(MA 1150 CR MA 1160 (4), MA 2150 CR MA 2160 (4), MA 2230 (2) OR MA 2330 (3), MA 3924 (3), (CS 1010 OR CS 1121(3)**), Electives (3 cr): (MA 2710 (3) OR MA 2720 (4), (MA 2820 (3) OR MA 2910 (3), (MA 4090 (3) OR MA 4308 (3), MA 1910 (3), MA 1920 (3), MA 1930 (3), MA 1940 (3)

Physics—24 cr*  
PH 1100 (1), PH 1200 (1), PH 1600 (2), PH 1610 (1), PH 2100 (3), PH 2200 (3), PH 2300 (2), PH 2400 (2); Electives (8 cr): additional PH courses at the 3000 level or above

Science—24 cr*  
BL 1010 (4), (BL 1020 (4) OR BL 1040 (4)) AND (BL 2160 (4) OR BL 2170 (4)), PH 1110 (4), PH 1600 (2), PH 1610 (1), (PH 2100 (3) OR PH 1110 (3), GE 2000 (3), GE 1120 (4)

(Labs must be taken in all classes, which have labs)

Social Studies—24 cr*  
EC 2000 (3), EC elective (3), SS 2600 (3) AND (SS 3600 (3) OR SS 3630 (3) OR SS 3940 (3)), SS 2550 (3) AND (SS 2500 (3) OR SS 3500 (3)), SS 2100 (3) AND (SS 3300 (3) OR SS 3400 (3) OR SS 3410 (3))

** MTTC (Michigan Test for Certification) must be taken for all minors.

** (CS 1010 or CS 1121 can be dropped if the Calculus with Technology series is taken, but you must take another 3 credit elective.)

Social and Behavioral Studies Minor (18 cr)

Department of Social Sciences

A minor in Social and Behavioral Studies focuses on the relationship between society, culture, and the individual in institutional life. It provides the non-major with basic tools to investigate the social causes and consequences of human behavior. The minor exposes the student to research, theory, and applications of social scientific knowledge of cultures, societies, group structures, and organizations, and how people think, behave, and interact within them.

Required Courses (18 cr)

Choose 6 of the following courses

Students must select at least one of the starred (**) courses:

HJ 3261 Intercultural Communications ........................ 3
PSY 3070 Cross-Cultural Psychology** .......................... 3
SS 2100 World Peoples and Environment .......................... 3
SS 2700 Introduction to Sociology ................................. 3
SS 2800 Science, Technology, and Society .......................... 3
SS 3100 Developing Societies [alternate years] .................. 3
SS 3700 Industry and Society ........................................ 3
SS 3710 Social Problems ............................................. 3
SS 3720 Social Psychology** ....................................... 3
SS 3740 Sociology of the Family .................................... 3
SS 3750 Social Inequality [alternate years] ......................... 3
SS 3760 Human Dimensions of Natural Resources ............... 3
SS 3810 Culture, Science, and Technology [all years] ........... 3
SS 3910 Histories and Cultures [on demand] ....................... 3
SS 4000 Ind Study [readings/res on social, cult., or behav theory] .. 1–3
SS 4010 Social Science Methods** .................................. 3
**Speech Presentation Minor (19 cr)**

Department of Fine Arts

Upon completing a minor in presentation, students will be able to communicate effectively orally and to present their ideas adequately. This minor targets people entering any field that demands competency in oral presentation.

**Required Courses—19 cr**

- FA 2090 Speech Communication ........................................... 3
- FA 2600 The Technique of Acting ........................................... 3
- FA 2660 Mainstage Theatre: Acting ........................................... 3
- FA 2820 Theatre Appreciation ................................................ 3
- FA 3700 Scenic Design .......................................................... 3
- FA 3750 Lighting Design ........................................................ 3
- FA 3780 Adv Theatre Interpretation .......................................... 3
- FA 4970 Final Project* ......................................................... 1
- HU 3642 Intro to Multimedia Dev ............................................ 3

* Course not available until academic year 2001–02

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**Structural Materials Minor (16 cr)**

Department of Materials Science and Engineering

Mechanical, biomedical, civil, and chemical engineers in industry routinely require expertise in materials to succeed in their careers, for example materials selection for mechanical design; failure analysis; and materials processing issues in manufacturing. In most cases, the knowledge of materials must be learned on the job. This minor addresses the problem by exposing students to the fundamentals and practical aspects of structural materials, emphasizing relationships between material microstructure, processing, and mechanical performance in engineering components. The core course work provides a foundation in structural materials and materials selection, while there are a large number of elective choices that may be tailored to individual career goals.

**Required Courses—9 cr**

- MY 2100 Intro to Materials Science and Engineering .................. 3
- MY 3400 Mechanical Properties of Materials ........................... 3
- MY 4800 Materials and Process Selection in Design .................... 3

**Elective Courses—7 cr**

Choose 7 credits minimum from the following:

- BE 3500 Biomedical Materials ................................................ 3
- CE 3101 Civil Engineering Materials ......................................... 3
- CM/CH 4610 Intro to Polymer Science ...................................... 3
- MY 3200 Materials Characterization I ...................................... 4
- MY 3219 Materials Characterization II .................................... 4
- MY 4130 Principles of Metal Casting ....................................... 3
- MY 4140 Ceramics and Powder Materials ................................ 3
- MY 4150 Composite Materials ............................................... 2
- MY 4160 Corrosion and Environmental Effects .......................... 2
- MY 4170 Materials and Energy in Society .................................. 2
- MY 4400 Deformation and Forming of Materials .......................... 4
- MY 4990 Undergraduate Research ............................................ 1–3

---

**Technical Theatre Minor (19 cr)**

Department of Fine Arts

A technical theatre minor enhances students' technical expertise by introducing an artistic component with an emphasis in theatre production through practical experience. It also provides an opportunity for students to use their technical orientation in other fields in an artistic context. Students will be able to demonstrate developed creative problem-solving skills and artistic skills in theatrical and non-theatrical design fields.

**Required Courses—19 cr**

- FA 1700 Technical Theatre Production ..................................... 3
- FA 2661 Mainstage Theatre: Crew ........................................... 3
- FA 2820 Theatre Appreciation ................................................. 3
- FA 3700 Scenic Design ........................................................... 3
- FA 3750 Lighting Design ........................................................ 3
- FA 3780 Adv Theatre Interpretation ......................................... 3
- FA 4970 Final Project* ......................................................... 1

* Course not available until academic year 2001–02

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**Theatre Arts Minor (19 cr)**

Department of Fine Arts

The study of theatre adds breadth to the students' general university experience and depth to the students' studies in science, technology, and engineering. Students with a minor in theatre will have developed their creative, visual, and presentation skills; will understand the elements and principles of theatre; will have an understanding of the history of civilization through their study of theatre history and drama; and will have the tools and incentives for lifelong learning.

**Required Courses—13 cr**

- FA 2600 The Technique of Acting ........................................... 3
- FA 3700 Scenic Design ........................................................... 3
- FA 3780 Adv Theatre Interpretation ......................................... 3
- FA 3800 Dramatic Literature .................................................. 3
- FA 4970 Final Project* ......................................................... 1

**Elective Courses—6 cr**

Choose 3 credits from the following:

- FA 2661 Mainstage Theatre: Acting ......................................... 3
- FA 3810 Ancient Theatre History ............................................. 3
- FA 3820 American Theatre History ......................................... 3
- FA 3830 American Musical Theatre ........................................ 3
- FA 3840 Myth and World Theatre ............................................ 3

* Course not available until academic year 2001–02

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**Wood Science Minor (18–19 cr)**

School of Forestry and Wood Products

Wood is the single-most important industrial raw material in the world. The wood science minor will provide you with a basic knowledge of wood and engineered wood composite properties; industrial processing and manufacturing methods; and all types of wood products and will benefit your future career in engineering, forestry, business, or other fields.

**Required Courses—15 cr**

- RW 1035 Wood Anatomy and Properties ................................... 4
- RW 2046 Wood Physics .......................................................... 3
- RW 2083 Mill Tour and Seminar* .......................................... 2
- RW 3067 Composite Materials I ............................................. 3
- RW 4024 Wood Preservation and Drying ................................... 3

**Elective Courses—3–4 cr**

Choose one course from the following

- BA 3600 Quality Management ................................................ 3
- EC 3400 Economic Decision Analysis ...................................... 3
- RN 3010 Practice of Silviculture ............................................ 3
- RW 3068 Composite Materials II ............................................ 4
- RW 3077 Wood Chemistry and Pulping Processes ....................... 3
- RW 4085 Wood Biotechnology ................................................ 3
- RW 4087 Molecular Genetics of Trees ..................................... 3
- RW 4089 Plant Bioinformatics ............................................... 3
- MA 3710 Engineering Statistics .............................................. 3

* Course number will be changed to RW 3098.
Colleges and Schools

Michigan Technological University is divided into two colleges and three schools: College of Engineering, College of Sciences and Arts, School of Business and Economics, School of Forestry and Wood Products, and School of Technology.

Engineering at MTU

We’re world famous for educating engineers, and we’ve been doing it since 1885!

The major thrust of engineering is the creation of new processes, materials, products, or systems that are useful to society. Engineering demands a deep knowledge of physical, chemical, life, and social science; mathematics; economics and business principles; a broad knowledge of society—its values, needs, laws, and cultures; sound judgment; ethical behavior; and especially a high degree of creativity.

The engineering programs at Michigan Tech are designed to provide experiences that enable students to develop the professional and interpersonal skills they need for successful and productive careers. An education at Michigan Tech provides an understanding of technology at many levels. We want that understanding to enrich and empower students’ lives so that they can reach their greatest potential. Here’s some of the things engineering students do at Michigan Tech:

• In the Enterprise Program, students will run their own company and work on real-world engineering problems supplied by industry.
• In the Process Simulation and Control Center, chemical engineering students direct the processing of chemicals from a Honeywell computer control room.
• Materials science and engineering undergrads have their own labs, including one with a scanning electron microscope.
• A team of mechanical engineering students won an award for using software to design and analyze the suspension system of a Formula car.
• Environmental engineering students monitor air, water, and soil for harmful chemicals and engineer solutions for all types of environmental problems.
• Electrical engineering students designed and constructed a solar-powered vehicle to compete in the 1999 Solar Car.
• Civil engineering students compete in steel bridge, concrete canoe, and timber-beam competitions.
• Mining engineering students have access to an experimental underground mine for research and demonstration purposes.
• Geology, geological engineering, and applied geophysics students perform fieldwork in the superb natural laboratory afforded by Michigan Tech’s location.
• Our newest degree program, computer engineering, trains students to design, construct, and operate digital equipment, from cell phones to microwave ovens.
• The popular biomedical engineering option focuses on research and design skills that can be applied in industries that produce medical and surgical items.
• Students who are undecided about a specific field of engineering may explore program options in the engineering fundamentals program.

Special Opportunities

The faculty in the college of engineering have developed new and innovative curricula to better prepare our graduates for the challenges they will face during their professional careers. Each engineering program has constructed unique curricular experiences. In addition, several other programs or opportunities are available to students while they are completing a degree.

Special Programs

• First Year Engineering (nondegree)
• Enterprise Program
• Secondary Teaching Certification
• Earth Science w/BS in Geology
• Physical Science w/BS in Engineering

Graduate Programs

• Chemical Engineering—MS, PhD
• Civil Engineering—MS, PhD
• Electrical Engineering—MS, PhD
• Engineering (nondepartmental)—PhD
• Computational Science and Engineering
• Environmental Engineering
• Propulsion Systems Engineering
• Engineering, Master of
• Engineering Mechanics—MS
• Environmental Engineering—MS
• Environmental Engineering Science—MS
• Geological Engineering—MS, PhD
• Geology—MS, PhD
• Geophysics—MS
• Materials Science and Engineering—MS, PhD
• Mechanical Engineering—MS
• Mechanical Engineering—Engineering Mechanics—PhD
• Mining Engineering—MS, PhD

College of Engineering

www.doe.mtu.edu

Minerals and Materials Building, Room 712
906-487-2005 • 906-487-2782 (fax)

Dean
Robert O. Warrington (row@mtu.edu)

Associate Dean for Research and Graduate Programs
Neil J. Hutzler (hutzler)

Associate Dean for Academic Programs
Mark. R. Plichta (mrplich)

Undergraduate Programs

All BS degree engineering programs offered, except biomedical and computer engineering (new programs), are accredited by the Accreditation Board for Engineering and Technology (ABET). Both new programs will apply for accreditation during the next ABET visit. See p. 197 for details.

Biomedical Engineering, BS
Chemical Engineering, BS
Civil Engineering, BS
Computer Engineering, BS
Electrical Engineering, BS
Engineering (interdisciplinary), BS
Environmental Engineering, BS
Geological Engineering, BS
Geology, BS
Applied Geophysics, BS
Mechanical Engineering, BS
Materials Science and Engineering, BS
Mineral Process Engineering
Mining Engineering, BS

Minors
Earth Sciences Mining
Electronic Materials Remote Sensing
Geological Engineering Structural Materials
Mineral Processing

Special Programs

First Year Engineering (nondegree)
Enterprise Program
Secondary Teaching Certification
Earth Science w/BS in Geology
Physical Science w/BS in Engineering

Graduate Programs

Chemical Engineering—MS, PhD
Civil Engineering—MS, PhD
Electrical Engineering—MS, PhD
Engineering (nondepartmental)—PhD
Computational Science and Engineering
Environmental Engineering
Propulsion Systems Engineering
Engineering, Master of
Engineering Mechanics—MS
Environmental Engineering—MS
Environmental Engineering Science—MS
Geological Engineering—MS, PhD
Geology—MS, PhD
Geophysics—MS
Materials Science and Engineering—MS, PhD
Mechanical Engineering—MS
Mechanical Engineering—Engineering Mechanics—PhD
Mining Engineering—MS, PhD
First Year Engineering Program—A common first-year curriculum has been established for all engineering students. A total of 29 credits prescribed in the first year (of the 30 to 32 typically taken by a student) are common to each engineering program. Within this curriculum, a concerted effort has been made to integrate mathematics, sciences, and engineering courses in a way that demonstrates the interdependence of disciplines. As part of this program, students will participate in hands-on experiences within a number of engineering disciplines that are designed to help students better select the engineering field that best matches their interests and career objectives. The two guiding principles of the First-Year Program are that students will

- be able to easily transfer into or out of any engineering program within the college at the end of the first year;
- not lose any credits or time to graduation in transferring to another curriculum within the college after completion of the first-year program.

Those students entering the College of Engineering unprepared to choose an engineering major will be enrolled in the Department of Engineering Fundamentals and will still participate in the same First-Year Engineering Program. The faculty within engineering fundamentals will work with students through solid academic advising to help students choose an appropriate career field of study. Students must transfer into another academic department after they have been enrolled at MTU for three semesters (not including summer) or have completed 40 semester credit hours, whichever comes first.

Enterprise Program—As part of the engineering curricular reform, each department incorporates a major design experience for all students in their programs. One option for the students to satisfy this major design component will be a multiyear, multidisciplinary real engineering experience called the Enterprise Program. Within this option, the college and University will establish a number of engineering entities (about 10 to 20, depending on student demand), each with a specific engineering mission or set of expertise. The enterprise, for the most part, will operate much like a real company in the private sector. The employees (students) will work on real-world problems supplied by industry. A major part of the experience will include a strong business and communication component in addition to the application of science and engineering to solve a design problem. Within the projects, the employees will solve problems, perform testing and analyses, make recommendations, manufacture parts (where appropriate), stay within budgets (real and imaginary), manage multiple projects, etc.

The enterprises will be standing organizational structures within the University made up of students in their second through fourth year. Students will enroll in the Enterprise Program for six continuous semesters (excluding co-op absences) for a total of 16 credits, consisting of about 13 percent of the entire undergraduate degree requirements.

Cooperative Education Program—The College participates in the University Cooperative Education Program, granting credit for controlled work assignments in business, government, and industry. Participation in the Cooperative Education Program is available to all engineering students.

International Study—The College has a number of working arrangements with universities in other countries with programs that enable MTU students to study abroad as part of completing their engineering degree requirements. An example of such a program includes the Global Engineering Education Exchange Program.


Honor Societies—Eligible students in the College participate in the following honor societies: Tau Beta Pi (for all branches of engineering), Sigma Gamma Epsilon (geology, geological engineering, and mining), Pi Tau Sigma (mechanical), Chi Epsilon (civil), Phi Lambda Epsilon (chemistry/chemical engineering), Alpha Sigma Mu (materials science and engineering), Eta Kappa Nu (electrical).

Mission
We prepare students to create the future.

Vision
The College of Engineering will develop nationally prominent educational programs and research thrusts that will benefit all of our constituents and, in doing so, we will become a school of choice nationally.

Educational Objectives
The College of Engineering educational objectives are that students will gain

- the strong fundamental scientific and technical knowledge base and the critical-thinking skills necessary for work after graduation and that will serve as the foundation for life-long learning;
- the ability to apply engineering skills to engineering analysis and design projects and to creatively solve engineering problems;
- the ability to communicate effectively technical and professional information in written, oral, visual, and graphical forms and to work in teams;
- an awareness and understanding of their moral, ethical, and professional obligations to protect human health, human welfare, and the environmental and an awareness of the role of the engineering profession in a multicultural, global economy.

History
The College of Engineering has long and proud traditions in the education of engineers and scientists. The first degree, an undesignated BS, was awarded in 1888. The engineer of mines degree followed in 1890, reflecting the school’s focus on the rapidly expanding minerals industry in the Upper Peninsula of Michigan. Many of the graduates of Michigan Technological University’s early programs later became world leaders in the minerals and mining industries.

Responsive to the growing need for engineers and scientists in diverse fields, Michigan Tech has continually added new programs appropriate to its traditions and resources. More recently, new degree programs have been developed in environmental (1988), biomedical, and computer engineering (2000). MS and PhD degrees are available in most engineering departments. In addition, the college has added the degree of Bachelor’s of Engineering, a unique, interdisciplinary program that allows faculty from several disciplines to define an engineering field of study in new and/or emerging engineering fields such as manufacturing and mechanical design.

Faculty
See individual department sections for faculty listings.
### College of Sciences and Arts

**www.cec.mtu.edu/csa**

Walker Arts and Humanities Center, Room 210
906-487-2156
906-487-3347 (fax)

Dean
Maximilian J. Seel (seel@mtu.edu)

### Undergraduate Programs

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<th>Chemistry, BS</th>
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<td>Clinical Laboratory Science, BS</td>
<td>Computer Science, BS</td>
</tr>
<tr>
<td>Humanities, AH (associate)</td>
<td>Pre-Professional Programs (prelaw, premedicine)</td>
</tr>
<tr>
<td>Liberal Arts (English, History, Interdisciplinary), BA</td>
<td>Music</td>
</tr>
<tr>
<td>Mathematics, BS</td>
<td>Applied Physics, BS</td>
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<tr>
<td>Applied Physics, BS</td>
<td>Physics, BS</td>
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<tr>
<td>Scientific and Technical Communication, BS/BA</td>
<td>Social Sciences, BS</td>
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### Minors

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<th>Aerospace Studies</th>
<th>Journalism</th>
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<tbody>
<tr>
<td>American Studies</td>
<td>Mathematical Sciences</td>
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<tr>
<td>Art</td>
<td>Microbiology</td>
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<tr>
<td>Astrophysics</td>
<td>Military Arts and Science</td>
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<tr>
<td>Biochemistry</td>
<td>Music</td>
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<tr>
<td>Biological Sciences</td>
<td>Physics</td>
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<tr>
<td>Chemistry</td>
<td>Plant Biotechnology</td>
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<tr>
<td>Communication Studies</td>
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<td>Computer Science</td>
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<td>Ecology</td>
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<td>Environmental Studies</td>
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<tr>
<td>Ethics and Philosophy</td>
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<tr>
<td>Historical Studies</td>
<td>Technical Theatre</td>
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<tr>
<td>International Studies</td>
<td>Theatre Arts</td>
</tr>
</tbody>
</table>

### Special Programs

- **Fine Arts (nondegree programs)**
  - Theater, Music, and Arts Curriculum
- **Physical Education (nondegree programs)**
- **Physical Fitness and Lifetime Skills Curriculum**
- **Pre-Professional Programs (prelaw, premedicine)**
- **ROTC**
  - US Air Force Reserve Officers’ Training Corps
  - US Army Reserve Officers’ Training Corps
- **Secondary Teaching Certification**
  - Biology
  - Chemistry
  - Computer Science
  - English
  - Mathematics
  - Physics
  - Social Studies
  - Speech Presentation
  - Technical Theatre

### Graduate Programs

<table>
<thead>
<tr>
<th>Biological Sciences, MS, PhD</th>
<th>Chemistry, MS, PhD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computational Science and Engineering, PhD (interdisciplinary)</td>
<td>Computer Science, MS</td>
</tr>
<tr>
<td>Environmental Policy, MS (Social Sciences)</td>
<td>Industrial Archaeology, MS (Social Sciences)</td>
</tr>
<tr>
<td>Mathematics, MS</td>
<td>Mathematical Sciences, PhD</td>
</tr>
<tr>
<td>Physics, MS, PhD</td>
<td>Rhetoric and Technical Communication, MS, PhD (Humanities)</td>
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</tbody>
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### Sciences and Arts at MTU

The College of Sciences and Arts is a dynamic campus unit that offers the stimulating environment of a major university combined with the personal attention and supportive atmosphere possible in small, yet high-quality departments. Modern facilities and state-of-the-art equipment along with an expert, caring faculty assure students in the College of Sciences and Arts a first-rate education—an education that is highly respected by graduate schools and employers in the professional world.

Being a technological university, the role of technology in our college cannot be underestimated. The scientific and creative principles learned in classrooms are put to work in laboratories, multimedia centers, and computer centers, and in undergraduate research projects. We find that new technologies have entered all areas of our curriculum, from calculus (now taught using the advanced computer algebra system Mathematica) to scientific and technical communication, an area where focused students who also have other interests and who will be representatives of a new breed: persons whose technical expertise can be put to use in the specialized context of their application area.

We expect our major innovative research and education thrusts in the new century to be focused on emerging interdisciplinary areas such as bioinformatics and biotechnology, remote sensing, materials science, bio-engineering, information technology, and environmental science. We expect to launch new programs that provide a niche for technically focused students who also have other interests and who will be representatives of a new breed: persons whose technical expertise can be put to use in the specialized context of their application area.

Our departments feature exciting research activity that often involves undergraduates, innovative pedagogical experiments in the classroom, interdisciplinary research and course work, dynamic award-winning faculty, exciting job prospects, and the opportunity to make a difference.

- **Biology undergrads do lab and research work that is traditionally encountered only at the graduate level. Research, such as that conducted by the Lake Superior Ecosystems Research Center, greatly enhances your education.**
- **Pre-medicine provides excellent preparation and placement in medical, dental, and veterinary schools across the country. The clinical laboratory science program, one of the largest in Michigan, offers several options for combining course work with internship at accredited teaching hospitals, including the Mayo Clinic.**
- **Computer science students work on projects such as developing software and designing algorithms for determining DNA structure. Students have access to two SUN SPARC20 compute-and-file servers, thirty-eight color SUN workstations, and an Intel iPSC2 vector hypercube parallel processor.**
- **Chemistry students participate in research projects such as creating better plastics and developing improved batteries for the NASA space program. Physics students conduct leading-edge research in computational physics and imaging, and they recently launched rockets with high school students.**
- **Students in the social sciences choose from the traditional anthropology, archaeology, geography, history, political science, and sociology; or the interdisciplinary science, technology, and society program.**
- **The scientific and technical communication program, the largest of its kind in the nation, allows students to specialize in media such as computerized graphic design, Web-page development, publications, photography and video, or technical writing. Because we live in a global society, MTU offers certificate programs in French, German, and Spanish language and area studies.**
- **Undecided students may enroll in the sciences and arts undeclared program, allowing them to complete the general education requirements while exploring the various opportunities available at Michigan Tech.**
Special Opportunities

First-Year Undeclared Program—This is an option for students who choose not to declare a major in their first year. The students are provided with orientation sessions and a full range of services (including career counseling, academic advising, and peer-mentor counseling to aid students in defining career and academic goals) leading to the choice of a major.

General Studies—Offered to students who are seeking admission to a four-year degree program, but who are not yet academically qualified. They are members of the College of Sciences and Arts and are advised by the Sciences and Arts Undeclared advisor.

Pre-Health Professions Option—offered for students planning to study for professional degrees in medicine or dentistry. These programs meet all course requirements for admission to medical and dental schools in the U.S. and Canada. In addition, this curriculum will fulfill the needs of students wishing to enter pharmacy or optometry schools. Refer to the Biological Sciences pages for more information.

Pre-Law Professions Program—The prelaw advisor guides students through course choices, arranges administration of the Law School Admissions examination, and mentors the process of application to law school.

MaCh 1—A Mathematics-Chemistry-Humanities summer bridge program for entering first-year students.

ROTC—Opportunities for Air Force ROTC students to obtain a commission in the Air Force, and to participate in the international job-shadowing program; leadership experiences and internship opportunities through the Army ROTC Program.

Certificate and Advanced Certificate in Modern Languages, Literatures, and Area Studies—MTU awards a Certificate and an Advanced Certificate in Modern Languages and Literature, as well as Area Studies in French, German, and Spanish. Students who meet specified course requirements are eligible.

Cooperative Education Program—All disciplines in the college are eligible for assignments in the University Cooperative Education Program, granting credit for specified work assignments in business, government, and industry. Participation in cooperative education is optional. Students in communication, computer science, and mathematics are often involved.

Professional/Honor Societies—Membership in the following professional or honorary societies is available to students:

- Biological Sciences—Phi Sigma, Society of Clinical Laboratory Scientists (SCLS), Society of Future Health professionals, Biomedical Engineering Society.
- Chemistry—Phi Lambda Upsilon Chemistry Honor Society
- Computer Science—Association for Computing Machinery (ACM).
- Humanities—Society for Technical Communication (STC).
- Mathematical Sciences—American Statistical Association (ASA), Mathematical Association of America (MAA), Phi Kappa Phi (open to all students), Pi Mu Epsilon.
- Physics—Sigma Pi Sigma, Soc of Physics Students (open to all)
- AFROTC—Arnold Air Society

Mission

We prepare students to create the future.

The College of Sciences and Arts provides the foundation, the fundamental principles, and the areas of creativity and enrichment which are at the core of all university learning. The college educates undergraduate and graduate students to have a global perspective and prepares them to reach their full potential in a technologically rich and ethnically diverse society.

Vision

Michigan Tech will be a national university of choice.

The College of Sciences and Arts will be a college with exciting programs, scholarship, and research in the science and technology niche. It will be an integral part of a university which is ranked in the top research tier by the Carnegie foundation. The success of our students will always be the most important measure. To that end, faculty and students will learn together in nationally prominent undergraduate and graduate programs which blend teaching, research, and scholarship; anticipate critical emerging directions; and cross the disciplinary boundaries.

History

In 1968, the MTU was divided into the College of Engineering, the College of Sciences and Arts, and the School of Forestry. For the first time in Michigan Tech's history, the sciences and arts were given their own identity. This date is more important for the sciences and arts than for engineering. Tech had always been synonymous with engineering. The act of 1968 started to change that image. It is in this spirit that we proudly celebrated, in 1998, the first 30 years of the College of Sciences and Arts and its contribution to Michigan Tech.

Enhancement of undergraduate education and the development of doctoral programs have been the two areas central to the evolution of the college. This underscores and articulates a vision of a university that is characterized by the unity of teaching and research. The change in the college's role and mission from one of undergraduate teaching alone reflects MTUs transformation from a predominantly undergraduate engineering college to a research university. Over the last ten years, the College of Sciences and Arts has become a strong partner in this change.

Today the college is, in terms of number of departments and faculty, the largest academic unit on campus. It teaches 51 percent of all student credit hours, and employs 48 percent of all MTU faculty.

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Accounting
Business Finance and Financial Economics
Industrial Marketing and Management
Management Information Systems
Economics—BS
Minor
Economics
Special Programs
Certificate in International Business
Certificate in Industrial Forestry (with SFWP)
Pre-Law
Graduate Programs
Mineral Economics, MS

Business and Economics at MTU
Our motto “Large Enough to Lead and Small Enough to Care” exemplifies our programs. SBE students receive a top-quality education and individualized advising, learn highly marketable skills, have opportunities to work in cross-disciplinary teams, can interact with science and engineering students, use superb computing facilities, and can develop long-lasting professional relationships with highly qualified faculty. Because of these strengths, SBE graduates have excellent placement and career advancement prospects, as well as an understanding of the need for life-long learning.

The SBE's Bachelor of Science in Business Administration (BSBA) degree program offers four concentrations:

1. Accounting: Accounting is the language of business. Accounting students learn to collect, summarize, and report financial information and evaluate the integrity of financial information systems.
2. Business Finance and Financial Economics: This concentration focuses on financial decision making in corporations, financial institutions, and investment-related organizations. Finance students learn decision-making techniques useful to analyze investments, to value securities such as stocks and bonds, and to understand how financial markets function.
3. Industrial Marketing and Management: Students selecting this concentration learn techniques for effectively anticipating the demand for goods and services and their effective coordination, development, promotion, and distribution, as well as production methods, technology management, human behavior, planning, and decision making, and quality management techniques.
4. Management Information Systems (MIS): The MIS program is the most rapidly growing SBE program. Students selecting this concentration acquire skills and knowledge needed to analyze, design, implement, and deploy information technology (IT) within technology-rich organizations.

The SBE's Bachelor of Science in Economics (BSE) degree program provides a strong analytical foundation for understanding how economies function and for solving economic, business, and social problems. Economics majors have the options of pursuing a broad curriculum mixing engineering, science, mathematics, social science, and/or business curricula with the study of economics.

Needed Background
A student interested in a career in business needs a solid preparation in high school mathematics, and communication skills are essential. Computer skills are becoming more and more important. Prospective students should be interested in working with people and technology or working with people who work with technology and enjoy the fast-paced world of business and technology.

Special Opportunities
Prelaw Studies—There is no single preparatory discipline for students considering law school. A baccalaureate degree in business, economics, engineering, humanities, or social science is suitable background for law school. However, undergraduate economics majors have had the highest average score on the Law School Admissions Test during recent years. For this reason, students interested in law school should consider the SBE's BSBA or BSE program. Pre-law students in disciplines other than business or economics should include some courses from the SBE's business, economics, and law curricula in their programs of study at MTU. The SBE offers a range of courses in business law, business organization, and governmental regulation and additional law courses supporting the technology missions of the School and University (e.g., labor law, law of technology). Recent graduates have studied law at the Universities of Michigan, Denver, and Wisconsin, Marquette University, and Ohio State University.

Certificate Programs—Conferral of the certificate will be noted on the student's transcript. Certificates can be obtained while working concurrently for a degree or by part-time students not pursuing degrees.

1. Certificate in International Business (24 credits)—This program is intended for any MTU student who plans to pursue a career related to international business.
2. Certificate in Industrial Forestry—The School of Forestry and Wood Products (SFWP) and the SBE jointly award this certificate. Business students can use the program to obtain working knowledge of the forestry and wood products industries. SFWP students can use the certificate program to obtain a working knowledge of business and management.

Cooperative Education Program—Business and economics students may participate in the University Cooperative Education Program and receive credit for controlled business or government work assignments. Assignments are distributed widely across the nation in a variety of activities.

Department Facilities
The SBE’s Tidwell Student Center provides students a comfortable environment for informal meetings, group study, computer research, and other student-related activities. The Center is supported by the Tidwell Endowment, which funds a broad range of activities in support of student organizations, tutoring and mentoring activities, and facilities for enhanced studying.

Mission
The mission of the School of Business and Economics (SBE) is to educate undergraduate students in business administration and economics. The SBE will draw students primarily from Michigan's Upper Peninsula and its surrounding region or from transfers and dual majors within MTU. The educational experience will be distinguished by
personal attention and guidance to students; a commitment to quality
education and continuous improvement; as well as an emphasis on
teamwork, information resources, and the link between business and
technology. Faculty are expected to emphasize quality teaching and the
development of excellence in teaching methods, while maintaining a
strong commitment to research and service.

Vision
To be recognized as a standard of excellence in the education and
development of future business leaders uniquely qualified to manage in
a technologically oriented workplace.

History
Since 1949, the SBE and its forerunners graduated 4,182 students, of
whom 76 percent (3,193) received the BSBA degree. Currently, the SBE
concentrates almost entirely upon undergraduate business education.
Ninety-eight percent of SBE students enrolled in fall 1999 were pursuing
the BSBA degree.

• 1949. The University established the Department of Engineering
Administration, the forerunner of the School of Business and
Economics. This department only offered a BS in Engineering
Administration (BSEA, later renamed the BS in Engineering
Management or BSEM) until the BSBA degree was introduced in
1957.
• 1970. The Department of Engineering Administration was expanded,
given academic autonomy, and reconstructed as a School of
Business and Engineering Administration (SBEA).
• Early 1980s. The SBEA introduced the BS in Economics (BSE) and
the Master of Science in Mineral Economics (MSME).
• November 1996. The School was renamed the School of Business
and Economics (SBE) to more accurately reflect its role within the
University. That year, the SBE introduced a dual BSBA program with
an expanded business core to replace the BSEM.

Educational Objectives of Individual SBE Degree Programs

BS in Business Administration (BSBA) graduates are expected to
1. develop a mastery of a broad core of knowledge of business with
knowledge of a specialized field. Students will possess
fundamental knowledge (concepts, tools, techniques, principles,
and procedures) of the following disciplines: accounting, business
law, economics, finance, management information systems,
marketing, operations management, organizational behavior,
quality control and management, and statistics.
2. demonstrate understanding of how to work in situations
characterized by cultural and demographic diversity.
3. manifest behavior compatible with productive participation in
group processes.
4. possess the analytical skills necessary to identify, formulate, and
solve business problems. Students who possess these skills
should, individually, and in groups, be able to identify, formulate,
and solve business problems contained in case studies in the
students’ capstone course, BA4700 Business Policy.
5. be well prepared for entry-level positions within organizations as
well as for productive careers in business.

BS in Economics (BSE) graduates are expected to
1. achieve a mastery of the fundamentals of economics that prepare
them for entry positions and graduate education.
2. learn the methods and techniques of economic problem solving.
3. be able to apply economic problem solving to ‘real world’
questions.

Graduate Program
The Master of Science in Mineral Economics (MSME) program
delivers graduate education to students with undergraduate technical or
business degrees who desire careers that combine economic skills with
technology in resource and/or environmental-related private or public
sector activities.

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Undergraduate Programs
Applied Ecology and Environmental Sciences, BS
Forestry, BS
Minors
Ecology (with Bio Sci)
Plant Biotechnology (with Bio Sci)
Plant Sciences (with Bio Sci)
Wood Science

Graduate Programs
Forestry, MS
Forest Science, PhD

Special Programs
Certificate in Industrial Forestry (with SBE)
Secondary Teaching Certification
General Science w/ BS, Applied Ecol & Environmental Sciences

Forestry and Wood Products at MTU

In one of the largest expanses of forest in the eastern United States and close to Lake Superior, MTU is in a perfect location for natural resources education and outdoor recreation. Students with an interest in a career involving the management and use of natural resources are able to select among three majors in the school. The hands-on education through Fall Camp for forestry majors, Summer Camp for applied ecology and environmental sciences majors, and participation in actual projects and research for all majors provides excellent practical applications and education. The SFWP is widely known for its research capabilities, and our research projects provide employment for many of our undergraduate students. Student clubs are active within each major. The low student to faculty ratio creates a friendly atmosphere in the school.

The BS degree in forestry is designed to educate students for scientific, technical, and management careers in forestry and renewable resources management. This degree program is accredited by the Society of American Foresters.

A graduate with the BS degree in Applied Ecology and Environmental Sciences will have a diverse and highly technical background in applied ecology and environmental science; be able to assess environmental conditions; make land-use decisions; and be able to solve ecological and environmental problems. Graduates are eligible to apply for certification as an ecologist by the Ecological Society of America. Students can also get secondary teacher certification in General Science with this degree. See SFWP and Department of Education for details.

Needed Background
High school students are encouraged to take a college preparatory program with emphasis on the natural sciences and mathematics. This will provide an excellent background for studying the scientific disciplines required by the undergraduate degree programs in the School of Forestry and Wood Products.

Special Opportunities
The SFWP offers a certificate in industrial forestry in conjunction with the School of Business and Economics, which is designed to give students a working knowledge of critical aspects of business, forestry, and wood utilization. This certificate is open to all degree- and nondegree-seeking students. Students who are interested in working in private industry should consider completing the certificate in industrial forestry. Students interested in cooperative education or internships can work with faculty members in setting one up to meet the needs of the student and employer.

Department Facilities
SFWP is located in one of the most densely forested areas of the eastern United States. Our unique facilities include a 4,700-acre research forest that serves as an outdoor laboratory for many courses, including most of the courses taken during the fall semester of the junior year for forestry majors. Applied Ecology and Environmental Sciences majors have classes in the school forest as well as nearby national and state parks.

A historic town and sawmill were a gift from the Ford Motor Company in 1956. Additional buildings have been added, including a modern dormitory. The sawmill is now a museum. These facilities provide a unique setting for students taking classes that make use of the school forest, which surrounds the Ford Center.

SFWP owns a pilot plant that enables students to study the development of wood products in a manner similar to an industrial setting. The school has a study-abroad program in ecology with the University of Veracruz.

Mission
A. To maintain outstanding undergraduate and graduate programs in forestry, applied ecology and environmental sciences, and wood science.
B. To develop and maintain an excellent research program which includes interdisciplinary research, complements educational objectives, and stimulates conservation and sustainability of natural resources, and maintenance and development of the forest products industry with efficient and ecologically sound use of federal, state, and private forests.
C. To advance the intellectual climate of the University through a competent and responsible faculty and research staff, and a cadre of excellent students.
D. To encourage students and school personnel to accept positions of leadership in the University, the community, and their profession.
E. To maintain a prominent role in forestry and wood science education and research in the state and region, as well as both nationally and internationally.

Vision
Our vision for now and the future is that the School of Forestry and Wood Products (SFWP) will be recognized throughout the state, region, and nation for its prominent role in forestry and wood science education and research.

The school will stress environmental responsibility. We will stress interdisciplinary research that complements the school's educational objectives. The school will advance the intellectual climate of the University through its competent, responsible faculty and staff and the courses they teach. The school personnel will be in positions of leadership in the University, community, and their profession.

Educational Objectives
A. Graduates with a BS degree from the school will have a firm understanding of basic principles of forestry or applied ecology and environmental sciences.
B. Graduates with a BS degree will have the ability to communicate orally and in writing, and be proficient with computer use.
C. Graduates with a BS in Forestry will have the necessary skills and ability to apply forestry principles to resource management. Graduates with a BS in Applied Ecology and Environmental Sciences will have the necessary skills and ability to address problems related to development and conservation.

Graduate Programs

The MS programs permit independent study in a broad spectrum of natural resources management or wood science. Interdisciplinary studies are encouraged and may include course work in engineering and science. Ordinarily, a research area is selected after consulting with the faculty concerning the student’s special interests. Course work is then planned based on the student’s background. Facilities are available for interdisciplinary studies among several academic units on campus and at the research forest.

The PhD program allows exceptional students to conduct research and pursue in-depth graduate studies in selected areas of forestry science. Incoming doctoral students are expected to have demonstrated outstanding ability in previous academic work and, normally, to have completed an MS degree program in an area associated with their planned area of study and research. Requirements for the PhD degree are consistent with Graduate School requirements.

For more information, refer to the current Graduate School Bulletin. Access the Bulletin online through the MTU home page.

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Associate Degree Programs
Civil Engineering Technology, AAS
Chemical Engineering Technology, AAS
Electrical Engineering Technology, AAS
Electromechanical Engineering Technology, AAS
Forest Technology, AAS

Bachelor’s Degree Programs
Engineering Technology, BS
Electrical Engineering Technology
Mechanical Engineering Technology
Surveying, BS

Technology at MTU

As engineering becomes increasingly math-oriented and academic, engineering technicians and technologists are taking over more and more of the hands-on, practical work that was once solely the realm of engineers. Technicians and technologists do specialized, technical work, often alongside engineers and foresters. The school’s associate degree programs in chemical, civil, electrical, and electromechanical engineering technology prepare engineering technicians for productive work as members of the engineering team. They are doers, builders of components, samplers, and data collectors. Technicians work with a minimum of direction from an engineer or engineering technologist. Technicians make judgements which deviate significantly from proven procedures.

The school’s programs of study allow the student who wants to earn a four-year degree in electrical or mechanical engineering technology or surveying to easily do so. Many people use associate degree programs in technology as a way to learn the basics, master math skills, or re-enter the field of education after a long absence from studies. Following graduation from a practical applications-oriented associate degree program, students are ready to tackle bachelor of science degrees in many areas, including engineering, engineering technology, business, scientific and technical communication, or forestry.

The school offers five degree programs in engineering technology. The BS in Engineering Technology degree offers two options: one in electrical engineering technology and the other in mechanical engineering technology. These programs prepare engineering technologists who are applications-oriented, who build upon a background of applied mathematics through the concepts of calculus. Their work is based upon applied science and technology. They produce practical, workable results quickly; they install and operate technical systems; they devise hardware from proven concepts; develop and produce products; service machines; and provide sales support for technical products.

Michigan Tech’s programs in technology stress practical applications and require less math than the bachelor’s programs in engineering and forestry. This coupled with an applied approach to subjects allows a student to gain confidence, establish math skills, and learn the practical aspects of a subject. Later, this background can allow a student to move on to more theoretical studies in engineering or forestry.

Accreditation

The AAS degree programs in chemical, civil, electrical and electromechanical engineering technology programs as well as the concentrations in the BS in Engineering Technology (electrical and mechanical engineering technology) are accredited by the Technology Accreditation Commission of the Accreditation Board for Engineering and Technology (ABET), 111 Market Place, Suite 1050, Baltimore, MD 21202-4012; telephone 410-347-7700. The surveying program (on-campus and distance learning) is accredited by the Related Accreditation Commission of the Accreditation Board for Engineering and Technology (ABET), 111 Market Place, Suite 1050, Baltimore, MD 21202-4012; telephone 410-347-7700. The forest technology program is recognized by The Society of American Foresters, 5400 Grosvenor Lane, Bethesda, MD 20814.

Special Opportunities

Degree Combinations—Associate degree graduates may choose to continue their education in MTU’s School of Business and Economics where they can earn a BS degree in business. This combination of a technical degree and a business degree is a valued combination of skills by employers. Other AAS graduates may find MTU’s BS in Scientific and Technical Communication to be exciting. With the combination of a technical degree and the communications degree, graduates are prepared to communicate the concepts of technology. Many students choose to continue their AAS degree by taking the BS degree with either the electrical or mechanical engineering technology option. Civil engineering technicians often continue their education by earning the BS in Surveying.

Co-op—All programs in the School of Technology offer the opportunity for co-op work experience. Co-op employment often leads to full-time employment after graduation. The time spent in co-op provides valuable work experience should an individual decide to seek employment with another company.

Professional or Honor Societies—American Society of Certified Engineering Technicians; Michigan Society of Professional Surveyors; Tau Omega Pi - Honor Society
Department Facilities

Students in several majors will have the opportunity to work in the School’s Technology Center, a building devoted to student projects and senior projects courses. The Technology Center, located 11 miles north of the main campus near Calumet, Michigan, provides space for classes ranging from computer system administration to internal combustion engines. For more information, see the school’s Web site <www.tech.mtu.edu>.

Forest technicians at MTU are able to study in a unique environment. Surrounded by thousands of acres of forest lands, students can study the wildlife, pests, and effects of fire on the forest environment.

Mission

The primary mission of the School of Technology at Michigan Technological University is to provide a quality education to students who wish to pursue a career in the practical application of engineering, forestry, or surveying principles.

Vision

The School of Technology intends to assist and meet the broad goals of the University on behalf of its students. The school will benefit the State of Michigan and society as a whole through a balance of quality education, and to provide the state and its industry with highly qualified graduates. This will be done by promoting diversity, creativity, leadership, and teamwork, and to educate students to meet the changing needs of an increasingly global, technical, diverse, and environmentally sensitive society. We will have a comprehensive, forward looking curricula that educates technically competent graduates who are effective communicators aware of the social, economic, and cultural context of their work.

Educational Objectives

Programs of study in the School of Technology are designed to emphasize the applications of engineering, forestry, and surveying. The learning approach is hands-on and practically oriented. The goal is to produce technicians, technologists, and surveyors who are prepared to step into industry and immediately become contributing members of the professional team of engineers, scientists, technicians, and technologists. The practical applications approach is attained by emphasizing laboratory based learning to complement traditional classroom lectures.

History

In spring 1966, Michigan Technological University became involved in offering Manpower Development Training programs in cooperation with the Michigan Department of Education. MTU first offered programs in engineering aide surveyor, drafting, engineering aide electronics, tax assessor, lumber grader, saw filer, head Sawyer, and forestry aide.

Based on expertise developed while offering Manpower Development Training programs and with the equipment furnished by the Michigan Department of Education, Michigan Tech choose to move into certificate and associate degree programs in the areas where competence had been developed while offering Manpower Training programs.

The Department of Applied Technology was created in August 1969. Since then, the department has grown to become the School of Technology, but continues to offer programs in the applications of engineering and forestry.

Following a review (during 1982) of MTU’s land surveying program, it was decided to transfer land surveying out of the School of Forestry and into the School of Technology. The transfer occurred prior to fall quarter 1984. In 1987, the name of the program was changed from land surveying to surveying to better reflect the changing nature of the profession.

In recent years, the school has added a four-year engineering technology bachelor of science degree with concentrations in electrical and mechanical engineering technology. Most recently, an associate degree in chemical engineering technology was added to meet the needs of chemical processing industries for skilled employees.

Faculty

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Departments

Aerospace Studies

www.aux.mtu.edu/afrotc

Aerospace Studies

The Department of Aerospace Studies focuses on military aerospace, providing students the opportunity to study one of our country’s major instruments of national power, the United States military. The student will study and apply leadership as it is practiced in civilian and military institutions and develop an understanding of the nature of international conflict; the formation of national security policy; the use of aircraft, spacecraft, and information to create political and military effects; and the development and organization of the United States military forces.

Air Force Reserve Officer Training Corps (AFROTC)

Any student interested in learning about aerospace power and leadership can take AFROTC courses for credit. In addition, for those interested in entering the US Air Force, AFROTC is looking for energetic, bright, physically fit young people with goals, dedication, and team spirit. We want tomorrow’s leaders—people committed to integrity, service, and excellence, who will serve their country and preserve its freedom.

As an AFROTC cadet, you’ll enjoy the team spirit that comes with being a member of a great organization, including the social and extracurricular activities. You are also entitled to many benefits. They include

- AFROTC scholarships—not based on financial need. (1) tuition, $480/yr (for books, lab, incidental fees) and $200/mo tax-free allowance while in school if you are awarded an AFROTC High School, In-College, Express, or Commander’s Leadership scholarship; (2) $3,000/yr for tuition, $450/yr for books, and $200/mo tax-free allowance for qualified cadets in the Professional Officer Course who are not on another AFROTC scholarship;
- free private pilot license if you are a pilot candidate and do not yet have one;
- travel on military aircraft on a space-available basis if you’re on an AFROTC scholarship or in the Professional Officer Course;
- orientation flights aboard Air Force and Civil Air Patrol aircraft;
- visits to Air Force bases;
- opportunity to delay entering active duty while you pursue a graduate degree;
- a challenging job after graduation, with 30 days of paid vacation each year, comprehensive medical and dental care, and part-time post-graduate college with up to 75 percent of tuition and fees paid, and the ability to compete for full-time, paid, salaried, post-graduate education up to the PhD level.

General Conditions for Enrollment

AFROTC as a route to become a commissioned officer in the US Air Force requires the following qualifications:

- a citizen of the United States or applicant for naturalization
- a full-time student
- in sound physical condition
- of good moral character
- at least 14 years of age or 17 if a recipient of an AFROTC 4-year scholarship
- able to complete graduation and commissioning requirements: (1) prior to age 27 as of June 30 of the year you plan to be commissioned if a scholarship recipient (waived through age 29 if you have prior military service), or (2) prior to age 26 if not on scholarship status but designated for pilot or navigator training, or (3) prior to age 30 if not on scholarship status and not designated for flying training

Career Opportunities

The AFROTC program prepares students to become commissioned officers in the US Air Force. The classes and labs ensure a seamless transition from college life to the active-duty Air Force. The variety of Air Force career opportunities available through AFROTC is extensive. It takes dozens of different career fields to run the Air Force. There are pilots and navigators, of course, but the Air Force also needs officers in space operations, engineering of every type, communication-computer systems, air traffic control, intelligence, weather, science, personnel, finance, public affairs, security forces, transportation, and other areas. Many Air Force jobs correspond directly to jobs in business and industry. Students completing the AFROTC program with a few years of experience as an Air Force officer are highly sought after by corporate America. The program is also an excellent foundation for students considering a career in the aerospace industry or Department of Defense.

Air Force ROTC at MTU

AFROTC is a route to becoming a commissioned officer in the US Air Force. Ideally, newly enrolled freshmen complete a four-year AFROTC program while taking their regular college curriculum, but a student can make a commitment to AFROTC anytime, as long as they have two years remaining to complete their degree. Once accepted as a cadet in the AFROTC program, the student becomes eligible for orientation flights in Civil Air Patrol aircraft, and can compete for scholarships and many special summer programs, including Freefall-Parachute Training, Soaring (non-powered glider operations), Combat Survival Training, British Exchange, Foreign Language Immersion, Pentagon Internship, and Job Shadowing programs in the US and overseas.

Special Opportunities

Our department has a minor in aerospace studies that is open to all students. Any student who is considering a career in the aerospace industry or the government defense department will find a unique opportunity to get an insider’s view of and familiarity with the military and aerospace forces.

Mission

The department’s mission is to produce leaders for the Air Force and build better citizens for America.

Vision

Our vision is to be a nationally recognized commissioning program creating leaders prepared to meet the challenges of the future aerospace force’s technology.
Educational Objectives

The overall educational objective of the Department of Aerospace Studies is to teach students about leadership and the synergistic application of air, space, and information systems to project military power.

Faculty

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Army—Dept. of Military Science

www.aux.mtu.edu/armyrotc

ROTC Center, Room B013
906-487-2650
906-487-3090 (fax)

Department Chair
Major George W. Wheelock (gwwheelo)

Undergraduate Programs
Army ROTC
Minor
Military Arts and Science

Army ROTC

The Department of Military Science offers instruction in the fields of leadership, management, and general military subjects. They also complement and enhance career opportunities in the students’ chosen academic field. The experience and skills acquired by students in the Army Reserve Officer Training Corps (ROTC) program are highly valued and sought after by corporations and government agencies.

Students who successfully complete the program may be offered a commission as a Second Lieutenant in the U.S. Army, U.S. Army Reserve, or Army National Guard upon graduation from the University.

Career Options

The US Army offers its newly commissioned officers with immediate leadership and traveling opportunities upon graduation. Our ROTC graduates immediately attend the different Army Officer Basic Courses (i.e. Engineer, Signal, Armor, Infantry, Chemical, and over ten other career areas) and are normally assigned to lead organizations consisting of 30–50 people. There are many opportunities for promotion and advanced civil schooling as officers progress. The U.S. Army also offers highly technical schooling and opportunities to work with corporations and other government agencies.

General Conditions for Enrollment

Equal Opportunity Enrollment—The Army ROTC program at Michigan Tech is open to all students regardless of race, creed, nationality, sex, or physical handicap. Strict academic and physical requirements are placed only upon those students who enter the advanced program and compete for a commission in the US Army, US Army Reserve, or Army National Guard. Note: There are no obligations or commitments during the first two years of Army ROTC unless you are a scholarship recipient.

Pay and Allowances—All advanced course and scholarship basic course students receive a $200-per-month tax-free subsistence allowance. During attendance at basic camp and/or advanced camp, students receive pay plus free room, board, and a travel allowance.

Scholarship Program—Army ROTC annually awards four-year, three-year, and two-year scholarships to eligible high school, undergraduate, and graduate students who apply. Students do not have to be enrolled in ROTC to apply. The scholarship pays tuition and up to $1,200 in on-campus fees. $450 annually in book allowances, and a $200-per-month tax-free subsistence allowance. Free room and board may be available.

Uniforms and Training Equipment—All uniforms, ROTC textbooks, and other training equipment are furnished at no expense to the student.

Army ROTC at MTU

The United States Army provides the Michigan Tech ROTC program with very experienced and caring faculty members in preparing future officers and developing good citizens. The faculty also provides academic advisement, life skills development, and general guidance to its participating students.

Special Opportunities

PE Credits—All students formally enrolled in the University are eligible to register for basic ROTC classes. US citizens are enrolled as ROTC cadets. Non-US citizens may be eligible to participate in ROTC upon approval of the professor of military science. The following laboratory courses, taken with the appropriate ROTC recitation class, can be used to meet the physical education credits required for graduation: AR 1011, AR 1012, AR 2011, AR 2012. All students taking a laboratory must also enroll in the appropriate recitation. Recitations may count for general elective credit. Also AR 1059, AR 1068, and AR 1075 count as physical education credits.

XTREME Sports—ROTC students are eligible for special training during the summer in programs such as Airborne, Air Assault, Northern Warfare Training, and Cadet Troop Leader Training (three weeks as a leader in a military unit).

Mission

To commission the future officer leadership of the United States Army and motivate young people to be better citizens.

Advanced Course (AR3001–AR4001)

To be a candidate for enrollment in the Army ROTC advanced course, a student must (1) be a citizen of the United States; (2) be a full-time student possessing a cumulative grade point average of 2.00 or higher; or a grad student with 3.00 or higher; (3) be an academic junior or grad student with at least two academic years remaining; (4) be in good physical condition; (5) be of good moral character; (6) successfully complete general screening tests as may be prescribed; (7) have either completed the basic course of instruction, received advanced standing from previous military service or Junior ROTC, or completed the ROTC basic camp (See Army ROTC Advanced Placement below); (8) be enrolled in an academic field leading to a bachelor’s degree or higher; (9) execute a written agreement with the United States government and accept an appointment as a commissioned officer in the US Army, if and
when tendered; and (10) actively participate in ROTC activities and physical training. There may be other requirements at the time of enrollment in the Advanced Course. The AR 3001 and AR 4001 level classes are restricted to students enrolled in the Advanced Course.

Advanced Placement
A two-year program is offered to students holding at least sophomore status who have not completed the Army ROTC basic course. Students may gain advanced placement by one of the following methods:

Basic Camp—Students who qualify physically and academically may attend a paid six-week basic camp at Fort Knox, Kentucky, instead of taking the traditional on-campus basic course. Basic camp is designed to give cadets experience equal to that normally received during the on-campus freshman and sophomore classes. University credit (up to 18 hours) may be granted based on satisfactory completion of basic camp.

Veterans and Personnel Enlisted in the Reserve Components—Students who have had previous military training or service in any branch of the Armed Forces may be eligible for advanced placement in ROTC. University credit up to 18 hours may be granted for this training.

Simultaneous Membership Program (SMP)—Students who are members of the Army National Guard or US Army Reserves can simultaneously enter the ROTC advanced course and draw pay, allowances, and incentives from both upon reaching junior academic status. SMP students earn reserve duty pay and the $200 ROTC stipend. Reserve Forces scholarships are also available.

Junior ROTC—Students who received three years of training in the Junior ROTC program are eligible for the Advanced Course in Army ROTC at the discretion of the Professor of Military Science.

Graduate Programs
Top Army ROTC students can compete for fully funded graduate school positions, including doctorate and medical school positions. Army ROTC students can request an educational delay to complete their postgraduate work.

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Advisors
Biological Sciences
Freshmen: Advisors will be assigned by your department during the third week of class. See John Adler, Dow 740 (7-2025), if you need to be assigned an advisor.

Clinical Lab Sciences
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Debbie Bose, Rm 734; 7-2254 (debose)

Pre-Health Professions
Ron Gratz, Rm 736; 7-2345 (rkgratz)

Undergraduate Programs

Graduate Programs

Biological Sciences

Minors
Biochemistry
Biological Sciences
Ecology
Microbiology
Molecular Biology/Biochemistry
Plant Sciences
Pre-Health Professions
Secondary Teacher Certification
Clinical Laboratory Science, BS
3+1 (3 yrs campus, 1 yr intern)
4+1 (4 yrs campus, 1 yr intern)
4+1 sec. teacher certification
Cytotechnology
Histotechnology

Biological Sciences

The biological sciences cover a wide range of topics, approaches, and technological applications from biochemistry and molecular and cell biology to ecology and ecosystem science.

Clinical laboratory professionals use their understanding of biology and chemistry to perform and develop laboratory test procedures. These procedures may be used to verify health, diagnose and monitor disease, make and test new medical products, and contribute valuable information to research projects.

Needed Background
To enter the biological sciences, a student should be analytical and have an appreciation for biological sciences. Since these sciences are becoming more technology driven every year, an appreciation of the use of technology is important. As in all sciences, integrity, responsibility, and the ability to work both cooperatively and independently are required. High school preparation should include courses in biology, chemistry, and math, particularly algebra.

Career Opportunities
Biological scientists may work as practitioners, teachers, and researchers. Practitioners, such as clinical laboratory scientists, physicians, horticulturalists, conservation officers, and pharmaceutical sales and technical representatives, apply biological knowledge to solve day-to-day problems. Teachers who are biological scientists work at all
levels. Researchers in industry, government, and academia create and develop new knowledge from pure scientific value to immediate commercial application.

For many, attaining a BS degree is only the first step in their professional development. With it, our students are fully prepared to enter graduate school in any area of the biological sciences or to enter professional medical education.

Biological Sciences at MTU

Our program integrates the fundamentals of biological sciences with the ever-increasing use of technology in these sciences. Course laboratories use ever increasingly sophisticated instruments and techniques. A student graduating from our program has performed many of the techniques used in commercial and academic biology laboratories. This experience provides a competitive edge when applying for jobs, graduate schools, or professional schools.

Undergraduate programs are available leading to the BS in Biological Sciences and the BS in Clinical Laboratory Science degrees. Specific concentrations within biological sciences are general biology, ecology, microbiology, molecular biology, biochemistry, plant sciences, pre-health professions, and teacher certification.

QLS has seven different options: QLS (diagnostic laboratory testing), histology (preparation and study of tissues), cytology (examination for and diagnosis of malignancies and cell abnormalities), teacher certification, research, microbiology, and business. Students may select a 4+1 or a 3+1 concentration. In 3+1, students spend three years at the University campus and attend an off-campus National Accrediting Agency for the Clinical Laboratory Sciences (NAACLS)-accredited clinical practicum during their senior year. 4+1 includes four years of study at the University and an optional fifth year of study off campus.

Special Opportunities

An honors program in biological sciences, the first one to be established at MTU, is for qualified students willing to conduct independent research projects during their senior year. Students may obtain a secondary teaching certificate in biology along with their BS.

Completion of a clinical practicum program qualifies students to take a national certification exam. Certification is highly recommended for those who wish to pursue careers in hospital-based diagnostic laboratories; although other laboratories that hire clinical laboratory scientists (such as pharmaceutical quality control or research labs, hospital and university research labs, and industry and government laboratories) often do not require certification. Certification is also available in specialized fields such as hematology and clinical chemistry.

Department Facilities

The department provides a wide array of instruments and computer facilities to facilitate the use of current technology in the study of biological sciences. Increasingly, biology is becoming technologically driven. Students acquire experience in their lab courses using these instruments and computational facilities so that they are technologically skilled and competitive biological scientists upon graduation.

Mission

To provide an outstanding education in the principle areas of biological sciences that will support student aspirations for careers and professional employment.

Vision

Faculty and students will engage in forward-looking, comprehensive curricula which integrate instruction, laboratory experience, and scholarship and which meet the highest national standards.

Educational Objectives (Biological Sciences)

The educational objectives of the Biological Sciences baccalaureate degree program will provide and produce graduates who

1. are knowledgeable of the molecular, cellular, organismal and ecological levels of organization;
2. have well-developed critical thinking and problem solving skills;
3. have developed basic laboratory skills in their area of interest or expertise;
4. will be able to design an effective experimental protocol, including statistical analysis, to investigate a problem in their area of interest or expertise;
5. have fundamental knowledge of the scientific method of investigation;
6. are capable of writing a scientific paper in the style for publication based on a set of experimentally derived data; and
7. are able to find, interpret, and analyze information from varied sources including primary literature.

(Clinical Laboratory Science)

1. have a fundamental understanding of molecular and cellular biology, genetics, and organismal biology as well as appropriate supporting knowledge in mathematics, chemistry, physics, and communications;
2. are furnished opportunities to acquire the theory of diagnostic laboratory assessment and to practice the fundamental techniques of laboratory evaluation of health and pathologic states;
3. learn to access, evaluate, and communicate information/data and think critically;
4. develop knowledge of the multitude of career opportunities available for clinical laboratory science graduates as well as pertinent professional and ethical issues.

Graduate Programs

Faculty and graduate students interact in a vigorous, well-funded program leading to both MS and PhD degrees. Department resources are focused in two areas: ecology/environmental biology and cellular/molecular biology, with a diverse group of research projects open to graduate students. The department also offers clinical laboratory scientists the MS degree with a concentration in clinical laboratory management. The graduate program in biological sciences frequently draws upon faculty in the areas of forestry, chemistry, mathematical sciences, and environmental engineering.

The program in cellular/molecular biology supports both MS and PhD research with essential equipment for gene isolation, cloning, and sequencing as well as electrophoretic instruments, ultracentrifuges, scintillation counters, and support equipment. The University’s setting near the world’s largest freshwater lake and the many nearby lakes, rivers, and streams, as well as extensive woodlands provides a wide array of research sites for ecology and environmental biology. For more information, refer to the current Graduate School Bulletin.

Faculty

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PhD, Michigan State University

David Dixon
Adjunct Assistant Professor of Biological Sciences
PhD, Rutgers University

Adjuncts—Clinical Laboratory Sciences
Michigan Technological University is currently affiliated with the following
NAACLS-accredited teaching institutions. The following people are Adjunct
members of MTU's faculty in the off-campus clinical laboratory science
programs:

DMC University Laboratories, Detroit, Mich.
Barbara Jenkins-Anderson; Joyce Salany

Sacred Heart Hospital, Eau Claire, Wisc.
Thomas Hadley; Kenneth Johnson

Saint Joseph’s Hospital/Marshfield Clinic, Marshfield, Wisc.
Gene Shaw; Virginia Narlock

Robert H. Knapp; Suzanne Tomlinson

St. Elizabeth Hospital, Appleton, Wisc.
Peter Podlusky; Celia Landin

St. John Hospital & Medical Center, Detroit, Mich.
Noel S. Lawson; Margaret Kluka

St. Vincent Hospital, Green Bay, Wisc.
Darrell P. Skarphol; Harlan Boyd

Wausau Hospital, Wausau, Wisc.
Kathy Belgea; Susan Raker-Johnson

William Beaumont Hospital, Royal Oak, Mich.
Joan C. Mattson; Nancy Ramirez
Special Opportunities
A full cooperative education program is available beginning during the sophomore year that provides practical industrial experience for those interested in gaining engineering experience prior to graduation.

Department Facilities
The Process Simulation and Control Center (PSCC) is a world-class laboratory facility used for undergraduate engineering laboratories and graduate research projects. The PSCC integrates the senior-level laboratory courses with advanced computer technologies for process simulation, evaluation, and control in an automated pilot-plant setting. The PSCC is funded by a consortium of different companies and their foundations in support of the department and its programs.

The Kimberly-Clark Process Design & Communication Center is a state-of-the-art technical classroom in which faculty and students can present multimedia technical presentations for instructional and research purposes. A unique feature of the center is the availability of computer technology, software, and resource materials specifically designed to facilitate learning in a team-oriented environment.

Mission
The mission of the department is to provide a high-quality educational experience which will prepare graduates to assume leadership positions within the chemical and associated industries; to foster and encourage the pursuit of new knowledge and innovative scholarship in the chemical sciences and engineering; to teach in modern classrooms and do research in state-of-the-art laboratory facilities; and to provide leadership to the chemical engineering profession through scholarship, teaching, and service. Further, all chemical engineering students should master chemical engineering fundamentals necessary to function as a professional in an appropriate-level engineering position; have the ability to acquire the skills necessary to tackle new problems and/or technologies such as critical thinking, resourcefulness, problem-solving and research skills; be able to effectively communicate their technical/professional material in written, oral, visual, and graphical forms; and be aware of the impacts on the responsibilities to society of chemical engineering.

Chemical Engineering
Chemical engineers design and operate complex processes, which safely and efficiently produce products with a minimum of environmental impact. They have traditionally played a key role in industries as varied as petroleum processing, energy, food, agriculture, polymers and synthetic fibers, pharmaceuticals, ceramics, and gasses, consumer products, and specialty chemicals. New opportunities abound for chemical engineers as they play increasingly important roles in developing artificial organs and joints, new "smart" materials that respond to their environment, microelectronics, pollution prevention technologies, and new drugs and drug treatments.

Needed Background
Students who major in chemical engineering should enjoy and be proficient in chemistry, physics, and mathematics.

Career Opportunities
Graduates of the chemical engineering program at Michigan Tech are well suited to immediately enter the workforce in virtually any aspect of the chemical process industries. Within the chemical industry, many graduates move onto senior management, prominent engineering positions, chemical sales positions, or research and development. Outstanding opportunities also exist for chemical engineering graduates to further their education in graduate school, law school, medical school, or dental school.

Chemical Engineering at MTU
The chemical engineering program at Michigan Tech is very challenging and requires a great deal of dedication and perseverance to complete. However, the career opportunities within chemical engineering are outstanding, and the Michigan Tech program provides graduates with a set of problem solving, engineering, and communication skills that will last throughout their careers.

All chemical engineering students take a required course focused on chemical process safety and the impact of chemical engineering on the environment. This course, developed at Michigan Tech, is the only one of its type in the US.

The PSCC laboratory facility provides chemical engineering students with one of the finest unit operations laboratory facilities in the world.

Many chemical engineering students are involved in undergraduate research projects with our faculty members. Often these projects result in presentations by these students at regional or national meetings and can lead to publication in highly respected journals. Undergraduate research opportunities of this type are one of the opportunities available to our students because of the significant role of research and the scholarship of discovery at Michigan Tech.
Chemistry

Chemistry is often called the "central science" since it is concerned with developing an understanding of the fundamental properties of matter at the molecular level, categorized as organic chemistry, inorganic chemistry, analytical chemistry, physical chemistry, biochemistry, polymer chemistry, etc. Many of the most exciting advances in chemistry are now occurring at the interface of these traditional areas of chemistry and also at the interface of chemistry with biology, physics, and computer science.

Background Needed

High school students who plan to become chemistry majors should be taking rigorous mathematics and science courses, including physics. Taking calculus or advanced placement chemistry is not necessary, but these courses might allow a student to begin their college studies at a slightly advanced level.

Students who succeed as chemistry majors are those who have developed an interest in the connection between the microscopic molecular world and the macroscopic world in which we live. They probe the structure/reactivity relationships of pharmaceuticals, plastics, dyes, or food; their interest is in all the substances that impact our daily lives.
Career Options

At Michigan Tech and nationwide, about 50 percent of graduating chemistry majors choose to continue their studies in graduate school in chemistry, biochemistry, or a related area. Many of these students have prepared themselves by participating in one or more years of undergraduate research, working closely with a faculty member and alongside other undergraduate students, graduate students, postdoctoral associates, and visiting scientists from around the world.

An increasing number of our chemistry majors prepare themselves for positions as secondary school chemistry teachers, and about 15 percent seek further education in medical or dental schools.

Approximately 25 percent of our chemistry graduates look for full-time permanent employment. Opportunities are available for students who wish to work in the pharmaceutical, chemical, and polymer industries. Some major employers of MTU chemistry graduates are Dow Chemical, Dow Corning, Chevron, Amoco, Post Cereals, and Oscar Mayer.

Chemistry at MTU

The Department of Chemistry offers a number of degree options that have been certified by the American Chemical Society: biochemistry, chemical physics, chemistry education, environmental chemistry, and polymer chemistry.

Faculty in the Department of Chemistry have been recipients of MTU teaching awards and research awards. All chemistry majors have a faculty advisor. The small size of advanced chemistry classes allows for students and faculty to know each other personally.

Our chemistry majors have an active student affiliates chapter of the American Chemical Society. Many of our undergraduates are involved in laboratory research projects in basic science, providing valuable practical experience as preparation for either graduate school or industrial employment and perhaps leading to publication of their work in the chemical literature. Our students participate in local and regional scientific meetings, and many are recruited by graduate schools nationwide.

Special Opportunities

Each year several chemistry majors participate in an external co-op arrangement. Many more of our majors take advantage of numerous opportunities for summer internships in chemical companies or at other universities. A growing number of students are participating in study abroad.

Department Facilities

The Chemistry Learning Center, which is staffed by undergraduate "coaches," provides an excellent opportunity for students in introductory first-year and organic chemistry to receive help. Students are enthusiastic and make extensive use of the facility and the guidance provided by their peers.

The department shares a computer network with the Department of Chemical Engineering and maintains two large computer laboratories. Numerous other computers are located in teaching and research laboratories throughout the building.

The Department of Chemistry has recently acquired an x-ray diffractometer, an instrument that is used for identification of crystal structures of newly prepared complex molecules. The atom-to-atom bonding sequence and the position of the atoms in three-dimensional space can be determined for substances for which a single crystal can be grown. With the addition of a Varian Unity Inova 400 nuclear magnetic resonance spectrometer to our existing NMR facility, we have extended our capabilities in this important area of analysis. This instrument allows an experimenter to unravel complex molecular structures using very small masses of sample. In a supporting role, we have gas chromatographs, ultraviolet/visible spectrophotometers, a mass spectrometer, laser-based emission spectrometers, spectrophotometers, and several infrared spectrophotometers. The knowledge and use of such instrumentation is a fundamental part of our chemistry education.

Mission

In accord with the University mission, we will endeavor to provide a balance of quality education and research experiences and to cultivate characteristics that encourage the personal flexibility necessary to meet the changing needs of our world. A university educates by providing the student access to the discovery, application, communication, synthesis and preservation of knowledge. A student who possesses a mastery of fundamental chemical knowledge and can communicate the results of analysis and experiment will be a competent scientist. The student who possesses these traits will, in accordance with the MTU mission statement, be a highly qualified graduate capable of meeting an industrial or academic challenge; a graduate capable of making positive contributions to chemistry in the twenty-first century.

Vision

The Department of Chemistry will be nationally known and recognized for the outstanding quality of its undergraduate, graduate, and research programs. Education and research in the chemistry programs will also support and provide the fundamentals for the University’s interdisciplinary strengths. The continual improvement in undergraduate, graduate, and research programs will necessitate a consistent advocacy by and support of the professional growth and development of all members—students, staff, and faculty within the department. Interdisciplinary programs between chemistry and other departments will facilitate an improved research climate for attracting additional University and external support.

Educational Objectives

The overall educational objectives are reflected in our mission statement. The three stated outcomes that are part of the department assessment plan follow. Undergraduate students should

1. master the fundamentals in analytical, inorganic, organic and physical chemistry.
2. be able to communicate results of experiment and analysis in written form.
3. be able to demonstrate an ability to work as a team to evaluate a chemical problem using scientific method and acquired problem solving skills.

Graduate Programs

The Department of Chemistry offers graduate research opportunities in a wide variety of research areas leading to MS and PhD degrees. All graduate students are supported as either research or teaching assistants. Graduates of these advanced programs are prepared to take a research position in the chemical industry, a government laboratory, or a teaching/research position at a college or university. Opportunities also exist for conducting portions of graduate research in off-campus facilities.

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Professor of Chemistry
PhD, Indiana University-Bloomington
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PhD, University of Kansas
Pushpalatha P. N. Murthy (ppmurthy@mtu.edu)
Interim Chair and Professor of Chemistry
PhD, Brown University
Civil and Environmental Engineering

As the technological revolution expands, as the world's population increases, and as environmental concerns mount, the skills of civil and environmental engineers will be vital. The next decades will be the most creative, demanding, and rewarding times for civil and environmental engineers. There is no limit to the personal satisfaction that you will feel from helping to make the world a better place to live.

Civil and environmental engineers are responsible for protecting human health and the environment. They also contribute to societal needs for design and construction of much of our infrastructure. They plan, design, build, and manage the facilities that are essential to our civilization—bridges, dams, highways, transit systems, airports, tunnels, irrigation systems, water distribution and wastewater treatment facilities, industrial and commercial buildings. Your assignments might place you at a computer work station, in front of a public hearing, or on a project work site. You will be at the forefront of technology.

Civil and environmental engineers are problem solvers meeting the challenges of sustainability, pollution control, the deteriorating infrastructure, traffic congestion, energy needs, floods, earthquakes, urban redevelopment, and community planning. The planning, design and construction of large, one-of-a-kind systems and structures is a hallmark of civil and environmental engineering.

Needed Background

Students need a wide range of interests and strengths. As in all engineering disciplines, strong mathematics and science skills are vital. But beyond that, there are some backgrounds and interests that are good indicators that a student might enjoy studying and be successful in preparing to be a civil or environmental engineer. Do you enjoy solving problems and putting your ideas into action? Are you curious about how things work and how to make them better? Are you interested in the environment? Are you socially aware and interested in helping people live better? These are some of the qualities shared by civil and environmental engineers the world over. They also make sound decisions and are good communicators, using skills in speaking, writing, and listening. If you share some of these traits, civil and environmental engineering may be the right career for you.

Career Opportunities

Civil and environmental engineers are the leading users of sophisticated high-tech products applying the very latest concepts in
Civil and Environmental Engineering at MTU

A civil engineering student can emphasize any one or combination of the several specialty areas—structural, environmental, geotechnical, transportation, water resources, or construction. Within environmental engineering, you will emphasize studies in water, air, and treatment processes. Within each of these technical specialty areas, you have several choices of the type of work you might perform. You can become involved in design, construction, environmental regulations, research, teaching, sales, or management.

Our faculty are nationally recognized for their innovative teaching efforts, their service to their profession, and their research which includes the ability to engage undergraduates in state-of-the-art problem solving. We have several faculty who have produced textbooks that are widely used at other universities. Our faculty have received grants from sources such as the US National Science Foundation and the Environmental Protection Agency to develop innovative curricular materials and perform other research. Undergraduate students often gain valuable experience by assisting faculty and graduate students in these efforts.

Our department and University provide students with the opportunity to develop personally and professionally in an intimate environment that is challenging, yet supportive; the student-faculty ratio is low; and, the mix of theory and practice is complementary. Most importantly, faculty and staff are always available to students for assistance in their classes as well as for mentoring.

Special Opportunities

Most students join one or more of the several professional society student chapters. These are the American Society of Civil Engineers (ASCE), Associated General Contractors (AGC), Institute of Transportation Engineers (ITE), Michigan Water Environment Association (MWREA), and Society for Environmental Engineering (SEEn). These student chapters provide opportunities to develop leadership and teamwork qualities and offer organized public service to the community. Many students attend regional and national meetings of these organizations as well as compete in various national competitions, such as the canoe and environmental design, through these organizations.

Summer internship experience can be lengthened and formalized through the cooperative education program, which alternates semesters of employment and school. Approximately 15 percent of civil and environmental engineering students participate in the cooperative education experience during their education.

During their senior year, about 90 percent of our students elect to write the national Fundamentals of Engineering examination. This examination must be successfully passed as part of the process of becoming a licensed professional engineer.

Department Facilities

The department's offices and laboratories occupy over 26,000 square feet in the newly constructed Dow Environmental Science & Engineering Building and 34,000 square feet in the adjoining Dillman Hall. Our computer facilities are constantly updated and currently consist of four large undergraduate computer laboratories that are equipped with SUN workstations and PCs.

Unique instructional facilities include specialized laboratories and equipment, a unique environmental process laboratory, state-of-the-art electronic classrooms, and a student activities and team work center. Students can also relax or study in an atrium that has an expansive view of the Keweenaw Waterway and the University's ski hill.

Mission

The mission of the Department of Civil and Environmental Engineering is to provide an educational, professional, and intellectual experience that enables students, alumni, faculty, and staff to contribute to society through teaching, research, practice, and service.

Vision

The Department of Civil and Environmental Engineering will educate students to become graduates of choice at all levels, baccalaureate, masters, and doctoral. Graduates of choice will be highly regarded and sought after, nationally and globally.

Educational Objectives

Michigan Tech civil and environmental engineering graduates will have:

1. a strong fundamental scientific and technical knowledge base and critical thinking skills to serve as the foundation for lifelong learning;
2. the ability to apply engineering skills to engineering analysis and design projects;
3. the ability to effectively communicate technical/professional information in written, oral, visual, and graphical formats;
4. an awareness and understanding of their moral, ethical, legal, and professional obligations to protect human health, human welfare, and the environment.

Graduate Programs

More than a third of the students who finish a degree in the department go on to graduate school. If you find one of the specialty areas particularly interesting during your undergraduate study and feel that you would like to work in that area as an engineer, then graduate school is an important first step.

The Master of Science in Civil Engineering (MSCE) can be obtained with a focus in one or more of the six specialty areas under civil engineering. For students who wish to specialize in environmental engineering, the Master of Science in Environmental Engineering (MSEE) is available with emphasis in water, air, and treatment processes. Students who have a nonengineering undergraduate degree and wish to get an advanced degree from this department may enroll in the Master of Science in Environmental Engineering Science program. Students who wish to combine graduate work with Peace Corps service can enter the Masters International Program. These students get a MSCE or MSEE after a year of course work and a two-year tour in the Peace Corps. Beyond the master's degree, the Department offers a PhD in Civil Engineering and a PhD in Environmental Engineering. Most students going on for the doctoral degree obtain a master's degree first.

Faculty

Professors

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PhD, University of Wisconsin-Madison

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Professor of Civil and Environmental Engineering; Adjunct Professor of Geology
PhD, Michigan State University

Martin T. Auer (mtauer@mtu.edu)
Adjunct Professor of Biological Sciences
PhD, University of Michigan

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Faculty

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PhD, University of Minnesota

Computer scientists study and develop techniques using computers for solving complex problems found in areas as diverse as medicine, science, the arts, and engineering. Computer science covers software engineering, programming languages, systems programming, numerical and scientific computing, algorithms, computation theory, computer architecture, database systems, graphics, artificial intelligence, and parallel computing. The computer is an important tool in modern life, and the continuing growth in the use of computers and computer applications has resulted in a tremendous demand for well-trained computer scientists in virtually every field.
Needed Background

A good indication of success in computer science is an interest in problem solving. Contrary to popular belief, not all areas of computer science require that students be whizzes in mathematics, although they are required to take a substantial amount of math.

It is not necessary to feel that one wants to spend all of one's time on a computer to succeed in the field. Some jobs are highly technical and require the majority of one's time working on a computer. Other jobs are more people intensive, involving numerous interactions with customers.

It is not necessary for students to have significant background in computing before starting at MTU, however, at least some exposure to computers is quite helpful. Students should get a good foundation in math, English, and the sciences in high school to provide them with the largest number of options in computer science.

Career Options

Students from our department have opportunities in a wide range of computing related careers. Typical job titles for our grads are software engineer, systems administrator, network administrator, intern administrator, programmer/analyst, computer specialist, project consultant, systems consultant, computer applications consultant, database administrator.

Many of our alums advance to the following kinds of positions: project manager, business systems, quality assurance coordinator, chief information officer, VP for software applications, lead engineer.

Some of our alums have started successful start-ups, producing a wide-range of products from computer games to software for medical devices to web-based shopping. Other alums are working as independent consultants. Finally, some of our alums have entered the education field, either teaching in 7–12 or as University faculty.

Computer Science at MTU

The Department of Computer Science has three BS-degree concentrations enabling CS majors to take an active role in choosing their courses and in preparing for careers in business, industry, and government, as well as for further studies in graduate school. The BS program prepares students for challenging positions in industry and business as well as for graduate school.

Recruiters consistently tell us that our alums outperform graduates from most other schools. Our seniors perform exceptionally well on the ETS Major Field Test. Our department average is consistently in the 95–99 percentile range.

Our graduates have the opportunity to interview with a very broad range of companies from computer and electronic companies to a wide range of other industries.

Special Opportunities

The department offers a minor in computer science.

We offer a wide-range of co-op opportunities from major corporations such as IBM or Dow to small start-up companies.

Students participate in campus activities that are educationally and professionally beneficial such as research projects, both within the department and across campus; jobs as lab consultants, student system administrators, etc.; and software development for various student organization projects, such as Solar Car.

Mission

The Department of Computer Science strives to be a nationally recognized contributor to our technologically rich society through a balance of high quality educational and research programs. To provide the foundation for a technological University and society, both intradisciplinary and interdisciplinary educational and research programs are fostered.

Graduate Programs

Students can get an MS in computer science or an interdisciplinary PhD in Engineering with a computational science and engineering focus. Students with an MS in computer science frequently have the opportunity to develop careers in R&D (research and development) at a wide range of corporations.

Faculty

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Department Chair (Interim)
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Advisor
Judy Anderson, Rm 203; 7-2460 (juanders)

Programs Offered
Major and minor programs leading to secondary school teacher certification are offered in the following fields:

- Biology (BS in Biology or Clinical Laboratory Science)
- Chemistry (BS in Chemistry)
- Computer Science (BS in Computer Science)
- Earth Science (BS in Geology)
- English (BA in Liberal Arts)
- General Science (BS in Applied Eool & Environ Science)
- Physical Science (BS in Engineering)
- Mathematics (BS in Mathematics)
- Physics (BS in Physics)
- Social Studies (BS in Social Sciences)

Minor
Psychology

Education

Few professions are as personally and professionally rewarding as teaching. Starting salaries of teachers are very competitive with other professions, benefit packages tend to be among the very best, few other professions provide as much time off (summer and holiday breaks), and the opportunity to work with young people is an exciting challenge. Ask any teacher and they will tell you that their days are never routine. Teaching is not an easy job, but the lifestyle of a teacher is among the very best.

Background Needed
What does it take to become a Michigan Tech trained teacher? First, a commitment to your academic discipline. Students are not admitted to teacher education unless they meet a set of rigorous admission criteria including maintaining a 2.5 GPA in both the academic major and academic minor. Attention to content is critical.

Second, a commitment to teaching. Our program is designed to provide students with a series of real-world, practical experiences. Michigan Tech student teachers spend time working with professional teachers and students in many different areas, and have the desire and commitment to work with students.

Education at MTU
Every education student at Michigan Tech is required to obtain an academic major and minor in his or her chosen field of study. In nearly every case, the rigor and major program are the same as non-education majors. In addition, students at Michigan Tech gain a wide range of real-world, practical classroom experiences that prepare them for the realities of the modern, technologically oriented classroom. This dedication to content and method means that our graduates have the knowledge to successfully begin a teaching career.

The Department of Education program, in cooperation with the academic departments, provides professional course work for persons receiving the bachelor of science degree in science, mathematics, computer science, or engineering and seeking certification at the secondary school level.

Teachers trained at Michigan Tech are teachers who are in high demand. School districts, principals, and superintendents all recognize that the quality of content preparation combined with a commitment to modern methods of teaching make Michigan Tech education graduates among the very best.

Admission
Students desiring admission to secondary teacher education certification programs must apply to the Department of Education office. They are also encouraged to consult with the education advisor soon after arriving at Michigan Tech.

Students may enter the certification program during any term. However, application is usually made during the sophomore year. Requirements for admission include 2.50 minimum overall grade point average and a recommendation from the dean of students (a postgraduate, student needs two letters of recommendation).

Special Opportunities
A minor in psychology is also offered through the education department. The courses are designed to help students develop an understanding and appreciation of both the lawfulness and diversity of human behavior. Students will find the offerings in psychology particularly relevant if they are planning to work in industry and business domains, community agencies, medical settings, or other professional areas in which significant interaction with people is required.

Mission
The mission of the Department of Education is to have exemplary programs for the preparation and continuing education of professional educators. In order to accomplish the mission, the Department of Education has developed a professional education program based on what it has identified as essential knowledge, established and current research findings, and sound professional practice. Each program is systematically and sequentially designed to reflect the philosophy and objectives of the department and University. Courses and experiences complement one another and are directly related to the purposes and outcomes.

The philosophy undergirding the mission is that general education (i.e., liberal studies) and specialty studies (i.e., content area) are part of the knowledge needed to become an effective educator. Coupled with professional knowledge, general education and specialty studies become interactive partners with the pedagogical knowledge base needed to make professional decisions. These knowledge bases are grounded in established and current research findings, sound professional practice, and social purposes of education.

Vision
The professional education programs at Michigan Technological University are committed to the integration of a strong content preparation with effective pedagogical skills designed to optimize classroom learning for all students. Our commitment to both a strong content knowledge base and effective pedagogy is grounded in the basic notion that quality teacher preparation is the responsibility of the academic disciplines, the Department of Education, cooperating schools, and, in fact, the entire University community. At Michigan Tech, teaching teachers is about cooperation.

Educational Objectives
The certification program approved for Michigan Technological University by the State of Michigan provides nine coded endorsements in both majors and minors. Of the endorsements, five are in science and one each in computer science, mathematics, English, and social studies. Michigan Technological University has accepted the Michigan Essential Goals and Objectives for Science Education (K–12), the grades 7–12 Mathematics Teaching NCATE/NCTM, and the work of the International Society for Technology in Education (ISTE) (Computer Science Department).
The framework and knowledge bases that support each professional program reflect multicultural and global perspectives, which permeate the programs. This is accomplished through course work and experiences interspersed in the general education, specialty areas, and professional education aspects of the curriculum.

The basis for the design of the curriculum is one that encourages lifelong learning with an emphasis on professional inquiry for informed decision making. The Department of Education has defined essential goals and objectives as performance indicators that evolve from the mission and the design of the curriculum. The following is a list of the goals and performance indicators by which students are formatively assessed at various stages in the professional education program and summatively during student teaching at the end of the undergraduate program.

Goal 1: The professional educator demonstrates an understanding of and appreciation for education and the role of intellectual and ethical virtues to a democratic and pluralistic society.

Goal 2: The professional educator verbally and nonverbally models effective communication.

Goal 3: The professional educator demonstrates knowledge of and appreciation for the humanities, the social sciences, the sciences, and the arts.

Goal 4: The professional educator understands and can apply effectively the professional general and specialty knowledge bases in the total learning environment.

Goal 5: The professional educator makes a commitment to provide educational experiences, which honor the uniqueness each learner brings to the learning community and which foster the positive development of the learner.

Other Requirements for Teaching

Student Teaching—Instructions for completion of the portfolio application are available in the Department of Education office. Portfolios and applications for student teaching are due the first week of the semester preceding the semester you plan to student teach. Students are urged to consult with the Department of Education advisor to determine the appropriate term for their student teaching assignment. The University cannot guarantee that individuals will be placed in schools of their choice. Students may have to be placed in locations that would require living away from the MTU campus.

Teacher Testing—All students must take and pass the Michigan Test for Teacher Certification (MTTC). This test is administered four times per year. Registration books and other materials are available in the Department of Education Office. Before applying for student teaching, students must show proof that they have passed the MTTC basic skills component. Before application for Michigan Teacher Certification can be processed, students must show proof that they have passed the MTTC subject area tests in each of their certification majors and minors.

Completion of the Conviction Statement form*—Any misrepresentation by a student concerning a matter governed by Department of Education admission requirements shall itself constitute a failure to comply with these requirements.

* The Conviction Statement form authorizes release to Department of Education of all records and information pertaining to any and all convictions for criminal offenses or penalties for violation of University regulations. It may be on file either at the Dean of Student Affairs office of the University, the Michigan State Police, or any other criminal justice agency. Through this form, students consent to the use and communication of such information by the faculty and administration of teacher education in assessing compliance with admission requirements. Department of Education reserves the right to refuse admission based on any criminal record that indicates the student might have an adverse effect on the teaching profession.
Electrical and Computer Engineering

Educational Objectives
Each electrical and computer engineering student must acquire
1. a strong knowledge base in mathematics, basic science, and
   engineering science as the foundation for lifelong learning;
2. the ability to use this knowledge base and to apply engineering
   skills to the creative solution of problems;
3. the ability to communicate effectively.

Special Opportunities
Students have many opportunities to have fun doing engineering
while at Michigan Tech. Six student professional societies call our
department home (IEEE Student Branch, IEEE Computer Society, IEEE
Power Engineering Society, Eta Kappa Nu, Audio Engineering Society, and
Husky Amateur Radio Club). In addition, students compete in national
events such as the Unmanned Robot Competition, Solar Car, and
FutureTruck.

Electrical and Computer Engineering
Electrical and Computer Engineering is about applying electrical and
computer technologies to solve problems and improve people’s lives.
Whether you are firing up your laptop, making a cell phone call, or
hopping behind the wheel of an intelligent automobile, you are using
hardware and software components designed, developed, and
implemented by electrical and computer engineers.

Needed Background
Students who want to major in electrical or computer engineering
should have a strong interest and aptitude in both mathematics and
physics. Electrical engineering students should also have an interest in
electrical hardware, while computer engineering students should have
an interest in computer hardware.

Career Opportunities
Because the technologies we deal with are fueling the information
age, our field is one of the hottest in engineering. Careers go far beyond
the utility and electronics/computer industries. Electrical engineers are
needed in virtually every industry, including computing,
communications, manufacturing, medical services, and aerospace. They
are involved with technology ranging from huge electrical transformers
to microchips no larger than the head of a pin.

Electrical and Computer Engineering at MTU
Our alumni have a wonderful reputation for “hitting the ground
running” faster than their competitors from other schools. Our two
programs, electrical engineering and computer engineering, are
interleaved so that all our graduates are able to help make our high-tech
world a reality.

Our faculty are some of the best teachers in the University, winning
both University-wide awards and regional and national awards. They
have developed a forward-looking curriculum, taking into account the
expertise and technologies required in the job markets of the future. By
blending the fundamentals with methods of modeling real-world
problems using digital signal processing, we ensure that our graduates
can step into jobs working with microprocessors, embedded systems,
electronics, communications, electromagnetics, or energy systems.

Mission
To provide quality educational programs in electrical and computer
engineering.

Future opportunities in all fields of technology, our graduates
are finding success in a variety of settings: consulting firms,
electronics manufacturers, medical technology, utilities, computer
companies, and government agencies. Some of our students
have created their own businesses, bringing to market new
products and ideas.

Mission
To provide quality educational programs in electrical and computer
engineering.

Faculty

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PhD, University of Missouri-Rolla

Associate Professor
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DECS, Washington University-St. Louis
Engineering Fundamentals

www.doe.mtu.edu

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906-487-3057
906-487-1620 (fax)

Department Chair
Sheryl A. Sorby (sheryl@mtu.edu)

The Department of Engineering Fundamentals serves a dual role within the College of Engineering. The department administers and offers courses in support of the common first-year program required of all engineering freshmen as well as other service courses within the college. In addition, Engineering Fundamentals serves as an academic home for students who are either (1) undecided about the engineering discipline in which they wish to major, or (2) do not yet meet the entrance requirements for direct admittance to the department of their choice.

Faculty

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Lecturer of Engineering Fundamentals
BS, Michigan Technological University

Fine Arts

www.fa.mtu.edu

Walker Arts and Humanities Building, Room 209
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Department Chair
Milton L. Olsson (miolsson@mtu.edu)

Advisors

All areas: Milton Olsson, Rm 209D; 7-2207 (miolsson)
Art: Mary Ann Beckwith, Rm 202B; 7-3285 (mabeckwi)
Theatre: Richard Blanning, Rm 209C; 7-3286 (rbblanni)
Music: Michael Irish, Rozsa Rm 203; 7-2145 (mjirish)

Undergraduate Programs

Minors
Art
Music
Speech Presentation
Technical Theatre
Theatre Arts

Why Participate in Fine Arts?

Fine arts programs are an important part of an education, whatever the student’s major. Students participate in fine arts programs both to develop skills that they bring to college with them and to try out new creative activities.
Fine Arts at MTU

- Students build skills not just in the arts themselves but also in teamwork, creativity and communication. These skills are valued by future employers.
- Some arts activities use students' scientific and engineering skills directly. Examples: Many students serve as theatre designers, sound engineers, lighting engineers, and recording engineers, learning hands-on applications through fine arts events.
- By participating in music, art, and theatre activities, students have the satisfaction of giving something special to the Michigan Tech community.
- Students also make some of their best friends in a music group, while working on a play, or in an art studio. Fine arts activities are both educational and fun, part of a balanced student life.

No previous training is required for beginning courses in fine arts. Some ensembles—the jazz bands, wind symphony, orchestra, and concert choir—are open by audition to students with a musical background. Fine Arts faculty assist students in finding the right place to begin participating in fine arts activities.

Special Opportunities

- **Music**—Membership in some music groups is by audition only, while others are open to all interested students. Vocal ensembles, consisting of the Concert Choir and E.C.H.O.E.S. from Heaven Gospel Choir, schedule several performances each year. The instrumental groups, comprised of the Keweenaw Symphony Orchestra, Huskies Pep Band, Jazz Lab Band, R & D Jazz Band, and Wind Symphony play a varied repertoire at concerts, dances, athletic events, and on tour.

- **Theatre**—Students with an interest in acting may audition for parts in University Theatre performances, which include comedies, classics, musicals, and experimental productions. The Troupe is an ensemble that performs comedy and improvisational scenes. In addition to participating as actors, students are needed forcostuming, set design, lighting, stage crew, and house management.

- **Visual Arts**—Courses in watercolor, oil painting, sketching and drawing, graphics, and three-dimensional design are included among MTU’s visual arts offerings. Student artists and photographers display their works in several annual exhibits, including the three-week-long Tech Arts Festival, coordinated by the Memorial Union Board.

- **Minors**—Students can select from a variety of minor degree programs in the arts, including music, speech presentation, theatre arts, technical theatre, and art. The music minor is a three-track minor under which students select one of three tracks: general music, music technology, or jazz idiom. See department for details.

Department Facilities

In the Rozsa Center, the Department of Fine Arts boasts excellent rehearsal halls and practice rooms, a recording studio, and a computer lab dedicated to the arts. The Rozsa Center also has a 1,100-seat performance hall that is visually and acoustically exceptional.

Walker Center has a versatile black box theatre and studios for watermedia, oil, drawing, and three-dimensional design.

Mission

The mission of the Department of Fine Arts of Michigan Technological University is to integrate the arts into the total University and community experience. The department offers avenues for artistic expression in the visual arts, music, and theatre for students, faculty, staff, and community members and provides opportunities to experience the arts through workshops, performances, and exhibitions.

Students are exposed to broad-based, academic and intuitive approaches to creative processes and innovation in the visual arts, music, and theatre through courses in the areas of appreciation, history, and theory, and they are provided with opportunities to develop as practicing creative artists in musical ensembles, theatrical productions, and art studios.

Vision

Fine arts department courses and programs will offer opportunities for students to discover, to refine, and to expand their abilities to create and to express, using techniques that only the arts can provide. By focusing on developing students' awareness of creative processes and stimulating their creative abilities, the fine arts department will help to prepare our graduates to meet the challenges and opportunities of the twenty-first century. Students who participate in arts courses and programs will have opportunities to develop and hone their creativity, their communications skills, and their leadership potential. Their fine arts experiences will promote diversity and will instill those values and qualities that make their lives vital to our society.

Faculty

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Assistant Professor of Theatre
MFA, Temple University

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Lecturer in Music
BA, California State University-Sonoma

DEPARTMENTS 101
Students are expected to have completed a college preparatory curriculum in high school or equivalent. Courses of study should include chemistry, physics, algebra, geometry, trigonometry, pre-calculus, English (especially written and oral communication skills), and social science. Courses in biology and earth science are desirable. Background in computers is strongly encouraged. Opportunities exist for those students strongly interested in the outdoors and to those interested in computers. Successful students will be highly motivated and interested in the earth they live on.

Career Opportunities

Exciting opportunities and a challenging professional career await students who pursue careers in the department of geological engineering and sciences.

Geological Engineering is engineering applied to human problems that relate to earth systems. It is a broad interdisciplinary field with many specialty areas such as exploration and development of energy and mineral resources; mechanical properties and behavior of natural material in engineering applications; environmental site characterization and planning; natural and human-induced hazard investigation and planning; and hydrogeology and groundwater engineering.

Geophysics is the study of the earth, earth materials, and earth systems. It is a physical and natural science and is involved in development of natural resources such as oil, natural gas, minerals, and groundwater; protection of the environment, remote sensing and land use planning; and natural and human-made hazard investigation.

Geophysics applies the principles of physics in the study of the Earth to discover what is inside. Applied geophysicists use measurements made on the Earth’s surface that are controlled by lateral and vertical variations in physical properties in the subsurface (i.e., density, magnetic susceptibility, electrical conductivity, elastic moduli, etc.) to explore for oil, natural gas, and minerals and in the construction of dams, roads, landfill, buildings, and waste repositories.

Needed Background

Students are expected to have completed a college preparatory curriculum in high school or equivalent. Courses of study should include chemistry, physics, algebra, geometry, trigonometry, pre-calculus, English (especially written and oral communication skills), and social science. Courses in biology and earth science are desirable. Background in computers is strongly encouraged. Opportunities exist for those students strongly interested in the outdoors and to those interested in computers. Successful students will be highly motivated and interested in the earth they live on.

Geological Engineering and Sciences

www.geo.mtu.edu

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Jacqueline Huntoon, Rm 430; 7-2412 (jeh)
Undergraduate Degrees
Applied Geophysics, BS
Geological Engineering, BS
Geology, BS
Earth Science Education
Minors
Earth Science
Geological Engineering
Remote Sensing (interdisciplinary)
Graduate Degrees
Geological Engineering, MS, PhD
Geology, MS, PhD
Geophysics, MS

Geological Engineering and Sciences

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Jacqueline Huntoon, Rm 430; 7-2412 (jeh)
Undergraduate Degrees
Applied Geophysics, BS
Geological Engineering, BS
Geology, BS
Earth Science Education
Minors
Earth Science
Geological Engineering
Remote Sensing (interdisciplinary)
Graduate Degrees
Geological Engineering, MS, PhD
Geology, MS, PhD
Geophysics, MS

Career Opportunities

Employment opportunities in geological engineering, geology, geophysics, or Earth Science education, are as varied as the interdisciplinary nature of geosciences itself. The BS degrees in these fields provide entry to beginning positions in industry or to graduate school. The broad base provided by these degrees have been used by some alumni for careers in other areas of science or other fields requiring familiarity with the earth and the scientific process.

Job opportunities include high-technology computer-based or laboratory-based activities, outdoor field work, maintaining offshore oil platforms, or working with young people in a classroom. Some jobs have the opportunity for significant national or international travel. Most graduating seniors find employment in the oil and gas, environmental, or mining industries, in federal or state government agencies, or in teaching. A master's degree can expand the employment opportunities beyond entry-level positions, particularly within major oil and gas companies, and a PhD is necessary for teaching at the college level or working in major research laboratories for industry or government.

Geological Engineering and Sciences at MTU

This nationally recognized department offers students an excellent educational experience that emphasizes geoscience applications and technology development in understanding and protecting the Earth. Excellent faculty and exceptional facilities provide special professional growth opportunities. The department offers a unique summer field geophysics course and its own summer field geology. The faculty foster independent thinking and research to empower students to apply their knowledge and achieve success in a global economy. They take a personalized approach to the education of undergraduate students.

Special Opportunities

Graduates with a BS in Geological Engineering are strongly encouraged to pursue registration as a professional engineer. Graduates with a BS in Geology, Geophysics, and Geological Engineering are encouraged to pursue licensure as a professional geologist. Graduates with a BS in Geology with an earth science education concentration must obtain teaching certification prior to employment at middle or high schools.

A wide variety of research activities are available and can be done independently or in collaboration with a faculty member. Financial support for some research opportunities is available.

Department Facilities

The campus is located near Lake Superior in a geologically rich environment that provides a natural outdoor laboratory for study by students. There are numerous rocks exposed within a rugged topography unusual to the Midwest.

The department has outstanding computing facilities with many SUN/PC workstations available for undergraduate computing, including black-and-white and color printers, large-format color plotter, and scanners. The department also maintains research computing labs that are used by upper-division undergraduates for courses and independent research. A variety of software for geoscience applications such as oil exploration, groundwater modeling, and mining is available. Industry partners have donated much of this software, valued at millions of dollars. A dedicated laboratory and excellent teaching collections facilitate the study of minerals and rocks. The department oversees the world-class Seaman Mineral Museum located on Michigan Tech's campus with its outstanding collection of minerals and rocks open to students and the general public. The museum's collection is also available for study.

The department maintains an undergraduate teaching laboratory for groundwater hydrology and another for undergraduate physical geology. Throughout the new Dow Environmental Sciences and Engineering Building, home of the department, there are laboratories for use by upper-division undergraduate courses and research by undergraduate and graduate students and faculty. These laboratories include a new X-ray diffractometer for mineral identification, a state-of-the-art...
paleomagnetic research facility, a hydrologic research facility, a rock preparation facility, a petrographic microscope laboratory, an applied geochemistry laboratory, and more. Undergraduate students also have access to excellent equipment housed in other departments. Quality study and project spaces are available within the department.

Vision
The Department of Geological Engineering and Sciences intends to be nationally recognized through education and research programs in geological engineering, geology, and geophysics. These programs emphasize geoscience applications and technology development in understanding and protecting the Earth and its resources. The department strives to foster an environment in which students learn to think, conduct research, apply knowledge, and achieve success in a global economy. The department and its graduates provide support for industry, government, and the general public.

Mission
BS in Geological Engineering—will provide students with a broad background in science and engineering, a thorough foundation in geology and sufficient depth and breadth in the areas of humanities, social science, and economics to ensure that they can function and communicate in an effective and responsible way in meeting the needs of society. Students will receive a thorough background in applied geophysics, which will support advanced engineering courses. To maximize the benefits to society, students will receive a balanced curriculum of junior- and senior-level engineering courses in energy resources, mineral resources, groundwater engineering, and geomechanics.

BS in Geology, Geology with Earth Science Secondary Education concentration, and Applied Geophysics—will provide students with a broad background in science, a thorough foundation in geology and sufficient depth and breadth in the areas of humanities, social science, and economics to ensure that they can function and communicate in an effective and responsible way in meeting the needs of society. Students will receive a thorough background in core areas of geoscience. To obtain a balanced curriculum with breadth and depth appropriate to the disciplinary program, students elect junior- and senior-level courses in geology, geophysics, education, and other areas. Throughout the geological engineering curriculum, students will develop and practice skills in the application of technologies for characterizing earth systems and resources and for designing systems to develop and protect these resources.

Educational Objectives
BS in Geological Engineering graduates of Michigan Tech must

- be able to function as a geological engineer in an entry level position or to continue in an advanced degree program in energy resources engineering, mineral resources engineering, groundwater engineering, or geomechanics, with special emphasis on applications of geophysics in these areas;
- be able to perform as effective members of multidisciplinary design teams by applying mathematics, basic science, field methods, computational tools, and engineering science in the design of economically effective solutions to modern geological engineering problems;
- be able to function and communicate in an effective way to meet the needs of a multicultural society in a professional and ethical manner, consistent with the well-being of the public in areas of health, safety, and the quality of their environment;
- be aware of the importance professional licensing and their obligation to continue in their personal and professional development by gaining new knowledge and skills in their area of expertise and by expanding their horizons into other areas of human endeavor.

BS in Geology, Geology with Earth Science secondary education concentration, and Geophysics graduates of Michigan Tech must

- be able to function as a geologist, earth science educator, or geophysicist in an entry level position or to continue in an advanced degree;
- be able to perform as effective members of multidisciplinary design teams by applying mathematics, basic science, field methods, and computational tools;
- be able to function and communicate in an effective way to meet the needs of a multicultural society in a professional and ethical manner, consistent with the well-being of the public in areas of health, safety, and the quality of their environment;
- be aware of the obligation to continue in their personal and professional development by gaining new knowledge and skills in their area of expertise and by expanding their horizons into other areas of human endeavor.

Graduate Programs
The department currently offers MS degrees in geology, geological engineering, and geophysics and PhD degrees in geology and geological engineering. Access the department graduate program online at <www.geo.mtu.edu>.

Students in the department may also enroll in interdisciplinary PhD degree in Engineering through the College of Engineering. We tailor individualized programs of study for MS and PhD candidates based on their interests and experience, and our current course offerings and research interests.

Faculty
Professors
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Associate Professors
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Humanities

Humanities students at Michigan Tech learn how to communicate technical and scientific concepts as well as incorporate social and ethical values into science and technology. The liberal arts degree program will introduce many academic areas, including science, math, literature, the arts, languages, philosophy, and history. Students can also take courses in other fields, such as engineering and business administration.

Students with an interest in technical subjects and nonfiction writing should investigate the STC (scientific and technical communication) program. Those with an interest in secondary (high school) or post-secondary (college) teaching should investigate our offerings.

Needed Background

High school students who enjoy working on the school newspaper, or in debate, or who have an interest in the mass media, or skills in modern languages or in literature would find a home in the Department of Humanities.

Career Opportunities

The department offers career-oriented degrees with strong demands in the business world (technical communication) as well as course work in the traditional humanistic fields for those who wish to prepare themselves for professional programs in law and secondary education.

Students obtaining a degree could enter a number of professions or apply for numerous professional programs. Students in the technical communication program may become technical writers/communicators, or they can continue their education by applying for graduate programs.
in rhetoric and technical communication. Students with degrees in virtually any area of the humanities may apply for entrance to a law school. In combination with work in the Department of Education, students majoring in English may receive their state of Michigan secondary teaching certificates.

Students with skills in modern language might work toward a language certificate and use this along with a business degree for a career in international business or with courses in social science for a career in international diplomacy.

**Humanities at MTU**

Our department is known for its discussion-oriented and writing-intensive classes that are taught by faculty committed to teaching and learning. We offer a high level of personal attention to individual students throughout their experience at MTU.

The humanities department consists of several academic areas: communication, English literature, modern languages, philosophy, scientific and technical communication, and writing and rhetoric. In general, the common link among all these areas is the transfer of ideas through the written and spoken word.

**Special Opportunities**

Certificates—The department offers a certificate and an advanced certificate in modern languages, literatures and area studies in French, German, and Spanish. Certificates can also be obtained in writing or media. These can be obtained concurrently while working toward a degree or by part-time students without enrolling in a degree program. All students, however, must comply with the procedures for admission to MTU. A secondary teaching certificate in English can be obtained in conjunction with the BA in Liberal Arts.

Minors—The department offers minors in communication studies, ethics and philosophy, and journalism. See department for details.

**Department Facilities**

The Center for Computer-Assisted Language Instruction (CCLI) is a fully equipped computer lab (Walker 113), designed to assist in the teaching of our entire undergraduate and graduate programs, especially in writing and technical communication. The lab offers both PC and Macintosh computers for individual student or class use, as well as necessary peripherals, such as specialized printers, CD burners, scanners, and multimedia generating equipment.

A multimedia presentation room (Walker 134) offers connections to the Web from the instructor's PC and Macintosh computers.

The Department also offers a video production laboratory for editing video materials (Walker 130).

**Mission**

The Department of Humanities is committed to achieving and maintaining excellence in all its programs by supporting curricula that are both rich and varied and that contribute a humanistic context for scientific and technological education of students who will seek and find careers in an increasingly global society. Such an effort involves balancing vigorous undergraduate programs with highly respected graduate programs, general education offerings with specialized majors, courses, and intensive academic study with challenging performance-based activities.

**Vision**

To play a central role in the education of students who will become engaged thinkers, adept communicators, open-minded leaders, and, most importantly, productive and socially responsible citizens of local and global communities in a culturally diverse and increasingly technological society.

**Educational Objectives**

In our undergraduate programs, our objective is to teach humanistic-oriented concepts in communication, creative writing, literature, modern language, philosophy, rhetoric, and technical communication.

The MS program is designed to prepare students to analyze complex problems in rhetoric and technical communication and devise effective and socially responsible solutions. Graduates will be qualified for positions in business and industry, or for further graduate study.

The doctoral program enables students to do advanced study and research into contexts of communication, with special attention to the function of communication in a technological society. The program prepares students for positions as researcher/teachers in universities: as consultant trainers in industry, government, and media.

**Graduate Programs**

The RTC program offers both MS and PhD degrees and engages faculty and students in interdisciplinary work focusing on the complex interactions among rhetoric and communication and their social and cultural contexts with special attention to the changing role of communication, information, and technology in contemporary societies.

The master’s program, in addition to preparing students for further graduate work, provides education for professional technical communicators, consultants, and trainers, as well as for high school teachers. The doctoral program prepares students for research and teaching in academic, corporate, and governmental settings.

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Undergraduate Programs
Materials Science and Engineering, BS
Mineral Process Engineering
Minors
Electronic Materials
Mineral Processing
Structural Materials

Graduate Programs
Materials Science and Engineering, MS, PhD

Materials Science and Engineering
Materials science and engineering touches on virtually every aspect of modern life. Current challenges to the profession involve engineering, development, and research in a wide variety of materials related technologies, including lightweight, high-strength materials capable of withstanding high and low temperatures for high-speed aircraft and space vehicles; processing of metals, ceramics, and composites to improve both economic competitiveness and product quality; biocompatible materials for medical applications, such as artificial joints, arteries, and hearts; materials that will permit efficient conversion, transmission, and storage of energy; advances in materials technology for powering and construction of safe, economical, and pollution-free transportation systems; materials with novel electronic, magnetic, and optical properties for information, computing, and communications systems; safe, efficient, and clean methods for processing minerals and raw materials from increasingly lean and complex ores; and recycling of waste materials in order to conserve natural resources and eliminate pollution.

Needed Background
Students interested in materials science and engineering should have strong backgrounds in the physical sciences, mathematics, and communications. Engineers in this field often work in interdisciplinary teams, and should be prepared to work with others and communicate effectively.
Career Opportunities

Because the properties of materials are critical to all engineering applications, career opportunities are vast. Stronger construction materials; lightweight, high-strength materials used in aerospace; electronic materials for computers; and special materials for medical devices such as pacemakers and artificial joints all stem from the work of metallurgical and materials engineers.

Materials scientists and engineers have an excellent job placement rate and above-average starting salaries. Graduates are employed by companies such as Texas Instruments, IBM, Westinghouse Electric, General Motors, Ford, Chrysler, Alcoa, Dow Corning, and Inland Steel.

In addition to these career opportunities at the baccalaureate level, graduates with good academic records have excellent opportunities to enter graduate school and seek advanced degrees.

Materials Science and Engineering at MTU

Students in our program benefit from close interaction with a world class faculty that is dedicated to student academic and professional success. Our students also enjoy access to state-of-the-art laboratories and instrumentation.

Our highly regarded Senior Design Program involves a yearlong team-oriented project, focusing on a real-world industrial problem. These design teams work closely with an industrial partner to plan and conduct a program leading to solution of the industrial problem. Several of these teams have won national awards for their projects. During their senior year, most of our students also have the opportunity to attend a national conference sponsored by one of the professional societies serving the field (e.g. ASM, TMS, ISS, MRS, SME).

This combination of people, resources, and programs has consistently developed graduates who possess reputations as can-do engineers who start quickly and who progress rapidly in their careers. Employment opportunities and opportunities for graduate-level education are excellent. A significant number of departmental scholarships are available for qualified students.

Students in materials science and engineering select degree options in either materials science and engineering or mineral process engineering.

Special Opportunities


Department Facilities

Extensive laboratory facilities are available, including X-ray diffractometers, scanning electron microscopes, an electron microprobe, atomic force microscope, scanning tunneling microscope, Auger electron spectroscopy systems, and scanning transmission electron microscopes. Capabilities for specimen preparation include molecular beam epitaxy, powder metallurgy, foundry, crystal growth, and zone refining. Equipment for mechanical property testing and materials processing is also available. Modern mineral processing laboratories are augmented by a pilot plant facility on campus. A departmental machine shop aids in constructing and maintaining experimental equipment. Students have 24-hour, 7-day-a-week access to a modern computer laboratory based on Windows NT workstations and SUN UNIX workstations. All workstations have Internet access, and students are encouraged to maintain personal home pages.

Mission

The mission of the Department of Materials Science and Engineering is to develop and disseminate understanding of structure-property-processing-performance relationships for engineering materials through instruction and research.

Vision

The department will be a nationally recognized leader in the education of students at the undergraduate and graduate level in the field of materials science and engineering. Its graduates will attain prominence in industry, government service, and academia. Its faculty will be nationally recognized for scholarship in both instruction and discovery.

Educational Objectives

The goals of our program are to produce graduates who

• have a sound understanding of the basic concepts of science and engineering in the areas of primary materials production, materials processing, and the properties of materials;
• are able to apply basic science and engineering concepts in the refinement, selection, processing, and design of modern materials used in engineering applications; and
• are able to communicate skillfully and effectively, both orally and in written form.

Graduate Programs

Graduate programs in Materials Science and Engineering include MS and PhD degrees. Research activities cover a broad range of materials (minerals, metals and alloys, ceramics, composites, electronic materials, etc.) and include both fundamental and applied research.

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Mathematical Sciences

Mathematics, the language of science, provides tools for discovery, understanding, and communication. The mathematical sciences are boundless; every other discipline is touched by some aspect of mathematics, so an interest in mathematics is easily combined with any other interest, whether it be computers, psychology, engineering, political science, physics, education, or medicine. And, of course, one might pursue the problem solving and precise and careful reasoning of pure mathematics.

Needed Background

A student who plans to major in mathematics should be curious and persistent, with a flair for precise thinking and reasoning. Incoming students should also have a solid foundation in high school algebra and trigonometry. Ideally, students who intend to major in the mathematical sciences should be ready to take a course in calculus (or beyond) their first semester.

Students who would like to develop their algebra and trigonometry skills may participate in MaDH-1, a summer program for incoming students, or take a precalculus course at MTU or a community college. For more information on programs for incoming students and advanced placement, visit our Web pages <www.math.mtu.edu>.

Career Options

Demand for mathematicians is increasing, primarily because of advancements in computing. Because the mathematical sciences are so wide-ranging, students who complete a degree can pursue a variety of careers. Mathematicians are needed for programming, numerical analysis, and logical design. And, because the computer makes it possible to develop and run complex mathematical models, business and industry depend on mathematicians to answer manufacturing questions. Mathematicians also find employment as teachers, as actuaries who calculate premium rates for insurance companies, and as statisticians who are experts on such matters as data analysis, predictions, and reliability testing.

Many MTU mathematical sciences graduates choose to pursue master's and PhD degrees. Others find employment with companies such as Ford, IBM, Zenith, Wausau Insurance, and Mutual of Omaha; and with government agencies such as the Social Security Administration, Bureau of Labor Statistics, and the National Security Agency. See our Web pages <www.math.mtu.edu> for a list.

Mathematical Sciences at MTU

The Department of Mathematical Sciences offers programs leading to the BS degree, with concentrations available in actuarial science, applied and computational science, discrete mathematics, general mathematics, secondary education, and statistics. At the graduate level, the department offers both master's and doctoral programs.

Many faculty have been finalists for Michigan Tech's Distinguished Teaching Award, and members have won it three of the last five years. In the last six years, two faculty members have won the statewide award for collegiate teaching, given by the Michigan Section of the Mathematical Association of America.

The department also has a distinguished research faculty. One of our faculty was awarded the Hall Medal by the Institute of Combinatorics in recognition of his extensive and significant body of research. Eight of our faculty serve on editorial boards of scholarly journals, and a substantial number of our faculty have received funding from the National Science Foundation and other governmental agencies to support their research.

The department is also known for innovative courses. Entering students can get immediate experience with mathematical research by taking an exploration-based course in Non-Euclidean Geometry, for example. Other innovative courses include Coding Theory (explores the mathematics used for modems, compact discs, and other computer technology), Mathematical Modeling (uses projects to explore how mathematics is used in science and engineering), and Survey Methods and Data Analysis, (uses projects to explore the role of statistics in science, industry, and government).
Special Opportunities

Secondary Teaching—The secondary education teacher certification program is unique. Not only is it a full math major that prepares students for a variety of careers, but it also incorporates experiences essential for future teachers: exposure to a variety of teaching methods and routine use of modern educational and scientific software.

Minor—The department offers a minor in the mathematical sciences. The department may soon offer certificate programs, such as an Actuarial Science Certificate. See the department Web page for up-to-date information.

Summer Programs—Students are encouraged to apply for summer programs, such as an NSF-sponsored Research Experiences for Undergraduates (REU) program, one of which is run at MTU.

Internships—Internships are available with insurance companies, pharmaceutical corporations, medical research firms, the automobile and aerospace industries, software companies, NASA, The National Security Agency, and various government agencies and labs.

Department Facilities

The department has over forty Sunray stations, purchased in 2000, in recently refurbished computer labs, as well as fifteen PC stations for use by our majors.

Graduate Programs

The doctoral program consists of three options: applied mathematics (the mathematics related to science and engineering), discrete mathematics (the mathematics related to computer science), and statistics. At the master's level, students may also elect an option in pure mathematics.

For more information, refer to the current Graduate School Bulletin, available on the Web from MTU's home page <www.mtu.edu>, or the information on the departmental Web page <www.math.mtu.edu>.

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Undergraduate Programs
Mechanical Engineering, BS

Graduate Programs
Engineering Mechanics, MS
Mechanical Engineering, MS
Mechanical Engineering-Engineering Mechanics, PhD

Mechanical Engineering

Mechanical Engineering encompasses the design, analysis, testing and manufacture of products that are used in every facet of modern society. The mechanical engineer may design a component, a machine, a system, or a process. Mechanical engineers analyze their designs using the principles of motion, energy, and force to ensure the product functions safely, efficiently, reliably, and can be manufactured at a competitive cost.

Mechanical engineers work in the automotive, aerospace, chemical, computer, communication, paper, power generation and many other industries. Mechanical engineers will be found in virtually any manufacturing environment. Increasingly, mechanical engineers are needed in the environmental and bio-medical fields. Virtually every product or service in modern life has probably been touched in some way by a mechanical engineer.

Needed Background

Potential mechanical engineering students should have an aptitude for and an interest in math and science. Students should take as much math and science as they can while in high school. In addition, it is useful to prospective students to take computer programming, computer aided drafting, and hands-on shop classes. Since effective communication is so important to practicing engineers, students should start developing strong writing and speaking skills while still in high school. In addition to all of the above, prospective mechanical engineering students should demonstrate a mechanical aptitude through a hobby that features mechanical systems or design activities.

Career Opportunities

Career opportunities are great; virtually every industry depends upon mechanical engineers. Mechanical engineers are needed to design and produce anything mechanical—automobiles, airplanes, space vehicles, power plants, computers, robots, furnaces, household appliances, medical equipment—to name just a few. In addition to careers in industry, mechanical engineers go to graduate school; become an entrepreneur or business owner; work for research and development labs, military, government, consulting firms; or enter other professions (law, medicine, teaching, etc.). Among the employers of Michigan Tech mechanical engineering graduates are U.S. Naval Avionics, Ford, General Motors, Boeing, Whirlpool, IBM, and Allen-Bradley. Our graduates excel in all walks of life. One in every twenty holds the title of chair of the board, chief executive officer, chief operating officer, president, or vice president.

Mechanical Engineering at MTU

The Department of Mechanical Engineering-Engineering Mechanics (ME-EM) has had a long tradition of quality education, hands-on experiential learning, nationally recognized student design projects, and excellent job placement. We value teaching and base our success on the success of our students. The department is currently the second largest ME department in the U.S. based on BSME degrees granted. But what is more telling is that we have been in the top four in this category in the U.S. for 16 consecutive years.

Our students (first year through seniors) travel nationally competing in a variety of collegiate design competitions such as FutureCar (3rd in 1999), SAE FormulaCar (8th in 1999), SAE MiniBaja (13th in 1999), Solar Car, SAE Aero Cargo Plane, FutureTruck (new in 2000), SAE Green Snowmobile Challenge (new in 2000). The ME-EM Department was selected as one of the U.S. Department of Energy Centers of Excellence, Interdisciplinary Challenge (new in 2000). The ME-EM Department was selected as one of the U.S. Department of Energy Centers of Excellence, Interdisciplinary Center for Advanced Propulsion, which is the only DCE center focused in combustion engine education and research in the United States.

Our faculty have been recognized regionally and nationally for their excellence in teaching and research. Eight of our faculty have earned the MTU Distinguished Teaching award and four have earned the MTU Research Award, the highest such awards at MTU. Four of our faculty have won the prestigious National Science Foundation Career or Initiation awards. Several of our faculty are Fellows, Medal of Honorees, past Presidents, etc., in national engineering societies.

Special Opportunities

Mechanical engineering students are strongly encouraged to participate in the cooperative education program, allowing students to integrate an industrial experience with their traditional course work. Students are also strongly encouraged to consider internships with a company.

Students benefit from joining one of the many professional and honorary societies that have student branches on campus: Pi Tau Sigma, Society of Automotive Engineers, Society of Manufacturing Engineers, Society of Women Engineers, American Society of Mechanical Engineers, National Society of Black Engineers, National Society of Professional Engineers, Society for Hispanic Professional Engineers, Tau Beta Pi, American Indian Science and Engineering Society, Society of Experimental Mechanics, and many other organizations.

Department Facilities

The department provides its students with progressive multiprocessor computing facilities that utilize a completely switched 100 Mb network environment, ensuring the highest quality bandwidth. Our students have
access to over 200 computers and workstations, and multiple software packages ranging from office suites to sophisticated 3D CAD/CAM/CAE programs with finite element and computational fluid dynamics capability. ME-EM students are provided complete internet access, color scanning, color laser printing, and 24-hour access to their computing facilities. All undergraduate labs are staffed by a group of volunteer students (Partners) who are available to assist fellow students with their computing needs. In addition, students have access to a conference room with video conferencing capability that can be used for senior design projects and distance learning programs.

Mission
The ME-EM Department will be nationally recognized as having one of the best undergraduate and graduate programs in the country. A healthy balance between undergraduate and graduate teaching and research will be the cornerstone of the department. A challenging curriculum, a supportive relationship between students and faculty, and an environment that welcomes diversity will be the hallmarks of the department as recognized by students, alumni, and industry.

Vision
To be a department of choice nationally at both the undergraduate and graduate level.

Educational Objectives
In order to accomplish its mission, the Department of Mechanical Engineering-Engineering Mechanics (ME-EM) maintains a strong academic program with the following educational objectives:

1. A graduate of the ME-EM Department should possess a solid foundation in and be able to apply the principles of basic science, mathematics, and engineering science to the solution of problems.
2. A graduate of the ME-EM Department should be proficient in the use of modern techniques, procedures, and information bases available to mechanical engineers, and be able to use them to solve structured and unstructured problems in mechanical engineering.
3. A graduate of the ME-EM Department should demonstrate the ability to design and develop useful products, processes, or systems.
4. A graduate of the ME-EM Department should be able to work effectively in a changing engineering environment and be able to pursue his/her interests through life-long learning.

The ME-EM faculty have identified the following learning outcomes that support our program educational objectives. Graduates of the ME-EM Department will have (a) an ability to apply mathematics, basic science and engineering science; (b) an ability to design and conduct experiments as well as to analyze and interpret data; (c) an ability to design a part, process, or system to meet desired needs; (d) an ability to function on multidisciplinary teams; (e) an ability to identify, formulate, and solve engineering problems; (f) an understanding of professional and ethical responsibility; (g) an ability to communicate their ideas effectively; (h) the broad education necessary to understand the impact of engineering solutions in a global and societal context; (i) a recognition of the need for lifelong learning; (j) a knowledge of contemporary issues; (k) an ability to use the modern techniques, skills, and tools necessary for engineering practice; (l) knowledge of chemistry and calculus based physics with depth in at least one of them; (m) ability to apply advanced mathematics through multivariate calculus, and differential equations; (n) familiarity with statistics and linear algebra; (o) the ability to work professionally in both thermal and mechanical systems areas including the design and realization of such systems.

Graduate Programs
The ME-EM department offers the Masters of Science in Mechanical Engineering, Masters of Science in Engineering Mechanics, Masters of Engineering, and PhD degrees for on campus students. In addition, the MSME, MEng, and PhD degrees are offered via distance learning with corporate partners. Courses are delivered using a variety of technology including video streaming, the Internet, and delayed videotape.

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Mining Engineering

www.mg.mtu.edu

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mining industry. Graduates of MTU's mining engineering program are employed by companies such as Cleveland-Cliffs, Kennecott Corporation, U.S. Gypsum, Marquip, and Allis Mineral Systems.

Mining Engineering at MTU

Mining engineering education and research have been traditions here for more than 115 years. The Michigan Mining School, established in 1885, eventually became Michigan Technological University. The Department of Mining Engineering has been certified by the Accreditation Board for Engineering and Technology continuously since 1936 and was one of the first mining departments in the US to be certified under EC2000 criteria. More than 800 mining engineers have graduated from MTU to achieve distinguished careers all over the world.

The faculty is a mix of professionals from academia, high-level research, and industry. Together they bring expertise in underground and surface mining, mining methods, mine planning and design, ground control and rock mechanics, health and safety, environmental issues, and ventilation to the training of new mining engineers. In addition to these basics, the faculty is proficient in mechanical and explosive rock fragmentation, materials handling, mineral processing, mine valuation, and resource/reserve estimation.

The department is guided by its Industrial Advisory Board, which consists of engineering, business, and consulting professionals. One member has been named one of the 125 most outstanding contributors to the global construction industry since 1874, and another is the chief operating officer of a major international mining company. Their input, along with input from current students, department alumni, faculty, and other practicing professionals, guides the department's activities.

The department initiated one of the first engineering enterprises: Resource Engineering Associates or REA (see Enterprise Program under the College of Engineering). REA consists of undergraduate students from many departments and at all educational levels, working together to solve real resource engineering problems for real resource companies. REA's first project was an evaluation of alternative methods for hauling mine rock from the blast area to the rock crusher in a large open-pit iron mine.

Special Opportunities

Non-mining students who want a background in the basics of mining without the requirements of a full engineering degree may opt for the minor in mining, which is designed to acquaint the student with the core concerns of producing mineral resources in the modern world.

Alternatively, a Certificate in Mine Environmental Engineering can be earned by undergraduates majoring in any MTU program.

Cooperative education and/or summer employment are strongly encouraged for mining students at any time after their first year.

In their junior year, students also are encouraged to take the Fundamentals of Engineering (FE) examination, the first step toward professional licensure (the second step is graduation from an ABET-accredited degree program like MTUs, the third step is four years of qualifying engineering experience; and the fourth step is passing the Professional Engineering (PE) examination).

A student chapter of the Society for Mining, Metallurgy, and Exploration is active on the MTU campus, and welcomes students with interest in any aspect of the minerals and resource industries. The chapter arranges field trips, speakers, and helps train and send teams to the National Mining Competition. This competition pits student teams from mining schools across the world against each other in contests of basic mining skills, such as jackleg drilling, hand mucking (shoveling broken rock), railroad track laying, hand steeling (drilling a hole in rock with a hammer and chisel), and other exciting events.

Department Facilities

The department provides examples of the broad spectrum of laboratories, software, and equipment that practicing mining engineers use, including surface and underground hard-rock mines. The historic Quincy Mine, begun in 1856, produced more than 460,000 tons of pure copper and descended to 8,800 feet (7,200 feet below sea level). In 1975 MTU excavated an easier access route to the underground workings. Classes now use parts of the mine to practice safety, underground mapping, sampling, mine monitoring instrumentation, drilling, and blasting and to study mining methods, rock mass behavior, ventilation, etc. In addition, the department maintains close ties with Cleveland-Cliffs Iron Co. (CQI), the world's largest producer of the iron ore pellets used in steelmaking. CQI owns and operates two large open-pit iron mines and associated mills, all of which are sites for field trips and ongoing research projects. Undergraduate students are indispensable participants in many of the department's research projects.

The department also maintains several computer laboratories: one for the general use of mining and metallurgy undergraduates, one dedicated to mine planning software, one for mining graduate students, one for geostatistics research, and one for satellite image analysis for mine design and geotechnical engineering. Four laboratories contain sample preparation equipment and strength-testing machines of various types for studying the mechanics of rock behavior. Mine ventilation, air conditioning, and air safety issues are studied in a large, well-equipped laboratory on campus in addition to the Quincy Mine. Laboratories for the study of rock fragmentation (drilling, explosives, and mechanical fragmentation) as well as for environmental effects of mining (groundwater, surface water, and air qualities) are also maintained.

The department is associated with the MTU Institute for Materials Processing, an internationally recognized group of scientists and engineers who study many aspects of the preparation of minerals and related materials for manufacturing and use.

Mission

The mission of the Department of Mining Engineering is to educate the leaders of the mining and resource industries of tomorrow. Our graduates are technology leaders who provide realistic solutions for today's problems.

Vision

While maintaining its established, solid reputation in traditional mining, the Department of Mining Engineering continues to expand into new areas of education and research in partnership with other departments. We will lead mining engineering in new directions in efficient resource recovery and environmental stewardship.

Educational Objectives

The Mining Engineering undergraduate curriculum is designed to instill the following basic attributes in our graduates:

• possession of a strong fundamental scientific and technical knowledge base, and critical thinking skills. These are the foundations of lifelong learning;
• the ability to apply science and engineering skills to analyze and design mining and minerals-related engineering projects;
• the ability to communicate technical/professional information effectively in all formats;
• awareness and understanding of professional obligations to protect health, welfare, and the environment in the production of minerals and related resources.

Our students, by the time they graduate, have taken typical mineral exploration information from raw data through orebody model generation, engineering design, permitting, feasibility study, and production scheduling to final reclamation. To begin this process, they already have demonstrated understanding of the fundamental physics and chemistry that control real-world processes and the mathematics that describe them.

Graduate Programs

The MS degree in Mining Engineering provides the opportunity for additional, in-depth training in a specialized area, such as underground construction, mine planning, mine economics, geostatistics, rock
mechanics, site characterization, rock fragmentation (explosive or mechanical), materials handling, environmental aspects of mining, or mine health and safety. Interdisciplinary engineering degrees (under the Master of Engineering program, see the Graduate School Bulletin) specialized for the needs of the student are encouraged. Innovative methods for the preparation of raw mineral products for specific manufacturing industries, for example, are urgently in demand. Traditional engineering education leaves a gap between resource production and manufacturing. The manufacture of industrial materials from raw minerals is not covered by any present engineering discipline, yet is needed urgently by many industries.

The PhD program in mining engineering is a rigorous experience in original thinking, producing engineers capable of conducting high-level research, managing technically demanding projects, and training other engineers.

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Physical Education

www.aux.mtu.edu/phys-ed/physed.htm

Why Participate in PE?

All MTU students must have 3 co-curricular units of PE courses to graduate. PE classes also prove to be a great stress release from academic life. They provide fun and develop social skills while enhancing personal wellness.

The department offers a wide variety of indoor and outdoor activities that will help students develop their own program of fitness while earning their co-curricular units. No physical education course may be counted more than once toward the three units required for graduation.

Physical Education at MTU

Facilities

Student Development Complex—The SDC, south of the main campus on Sharon Avenue, houses the MacInnes Student Ice Arena that seats 3,250 spectators for hockey, varsity and intramurals, as well as accommodating skating classes and free skating. The arena has dressing rooms and a pro shop.

The remainder of the SDC includes a multipurpose room with a 200-meter interior track and four basketball courts, a rifle/archery range, separate diving and racing pools, five handball-rcquetball courts and one squash court, a gymnasium that seats 3,100 spectators, a training room, weight training room, staff offices, locker rooms, dance studio, gymnastics room, and storage areas. The ticket office is on the first floor near the entrance.

Outdoor Sports Areas—include three play/practice areas, four softball fields, a football/track stadium that seats 3,000 spectators, and seven kilometers of cross-country ski trails. Cross-country rentals are available in the SDC.

Gates Tennis Center—Gates provides students with four indoor tennis courts, locker rooms for men and women, and a pro shop.

Golf Course—The University's eighteen-hole golf course, open to students, is located three miles from the campus on a site overlooking Portage Lake. The clubhouse has lockers, food concessions, club and cart rentals, and a pro shop.

Alpine Skiing Facilities—Mont Ripley, across Portage Lake from campus, is one of the Midwest's most challenging ski areas and has a double chair lift and a T-bar, as well as food concessions and rental equipment.

Bowling Alleys & Billiards Room—Located in the basement of the Memorial Union and used by the department for intramurals and classes.

Special Opportunities

Coaching Endorsement Certificate—The department offers classes that help support a secondary education program for students interested in coaching sports. The following courses are required to complete the certificate: PE 4010 Psychology of Coaching, PE 4020 Foundations of Coaching, PE 4050 Introduction to Athletic Training, PE 4100 Coaching Practice, and one or more elective credits.

Intramural-Recreational Sports Services—The Intramural Sports Program offers students, faculty, and staff the opportunity to participate in a wide variety of organized sports and recreational activities. The IM program provides a sound, attractive schedule of events that will appeal to the leisure-time pursuits of MTU students, faculty, and staff in approximately thirty-eight activities. Individual/dual sports include archery, badminton, basketball hotshot, basketball shootout, pickleball, racquetball, rifle shooting, squash, table tennis, turkey trot, swim meet, and wrestling. The team sports include basketball, ice hockey, soccer, softball, flag football, volleyball, wallyball, 3-on-3 basketball, water polo, and inner-tube polo.

Vision

The vision of the Physical Education and Intramural Department at MTU is to provide a total comprehensive package of wellness concepts for students, faculty, and staff. These concepts include participation in a minimum of three life-long sports units, an opportunity for involvement in a variety of intramural activities, as well as classes designed for raising the participant's level of consciousness on their own physical fitness/health-related issues. In an effort to remain responsive to student needs in a changing society, the Department of Physical Education will provide a basis for assisting the students in the development of positive attitudes toward lifelong activity and personal wellness.
Physics

The physicist investigates the fundamental rules that govern the way nature works using the scientific method and applies the understanding gained to both current everyday problems as well as to further human’s understanding of our place in the universe.

Needed Background

Students in physics should have an interest in understanding how the world works and an ability to use mathematics and computers. Incoming students will typically be ready to start calculus and many have already had some calculus before they come to MTU. While not required, many of our students will also already have a strong background in the physical sciences. Evidence of academic accomplishment in high school should include a GPA of at least 3.2 on a 4.0 scale, and an aggregate ACT score of at least 26.

Career Opportunities

The majority of physics graduates will end up pursuing a technically based career. Career paths of past graduates include academic careers as well as technical and often, ultimately, managerial, positions in high-tech industries. Over 100 different high-tech companies currently employ our physics graduates.

Students who graduate with an undergraduate degree in physics from Michigan Tech often pursue graduate study in all branches of physics, astrophysics, and materials science. Those who elect the applied physics degree find careers in a broad range of industries that are engaged in basic research and in multidisciplinary areas where problem-solving skills and a sound mathematical and conceptual orientation is desired.

Physics at MTU

Our faculty, as members of a nationally ranked graduate program in physics, are engaged in forefront research activities in many areas of physics, ranging from large-scale multinational efforts to small-scale “desk top” research. All of our undergraduate students are expected to participate alongside the faculty and graduate students in these research activities as part of their education. In addition to providing valuable contributions to the research endeavors, students get first-hand experience with state-of-the-art research activities.

The physics faculty believes in the unity of teaching and research. Three of our nineteen full-time faculty have won “Teacher of the Year” awards, indicative of our emphasis on high quality instruction, while two faculty have received the prestigious National Science Foundation Career award.
Our undergraduate program also features outstanding cross disciplinary opportunities in remote sensing physics, astrophysics, atmospheric physics, computational quantum, and materials physics for students who wish to ‘step outside the boundaries’ supplied by traditional programs.

Special Opportunities

Minors—The astrophysics minor supplies a rigorous introduction to observational and theoretical astrophysics at the undergraduate level. In concert with the BS in Physics provides students a solid foundation for graduate study in astronomy, astrophysics, or high-energy astrophysics. The minor in physics offers non-physics majors the opportunity to obtain a solid background in physics in preparation for careers in industry or further graduate study.

Leadership—Students operate the Physics Learning Center that provides instructional assistance to every student at MTU, administer the Society for Physics Students (SPS) study room and lounge, and perform research under faculty guidance in areas of their interests.

Department Facilities

Undergraduate students who are making good academic progress are welcomed in all of the laboratories and research programs, and have the opportunity to work alongside some of our nation’s leading researchers in physics.

A suite of research opportunities are available for qualified undergraduates. Experimental laboratories include the NMR Imaging laboratory, the Hyperspectral Imaging Laboratory, the Extrasolar Planet Detection Laboratory, the Dislocation Physics lab, the High Energy Astrophysics Laboratory, the Laser Guiding and Atom Lithography Laboratory, the Observatory, the Ferromagnetic Materials Laboratory, the Atomic and Molecular Spectroscopy Laboratory. Each lab is equipped with extensive research-grade equipment (in many cases, equipment that is unique in the world) and an abundance of high-end computational resources.

Computational laboratories span major efforts in ab initio modeling in computational atomic and molecular physics, studies of surfaces and interfaces, perfect and defective crystals, nanoclusters using atomistic and first principles techniques, Monte Carlo simulation of dynamics and equilibrium, growth, and etching of crystal surfaces and effects of intersecting dislocations, computer simulations of the protein folding problems, simulation of complex systems, and global optimization techniques. Major resources include 8 Ultras, a Silicon Graphics Origin 200 with four processors, an eight-node Beowulf cluster, and over thirty high-end Sparc and PC workstations.

Michigan Tech is deeply involved in the construction of the Pierre Auger Observatory—the world’s largest high-energy cosmic ray observatory. Students in physics at MTU have extensive opportunities to perform research in support of our own national and astronomical observatories.

Vision

The Department of Physics at MTU has one of the largest undergraduate physics programs in the state of Michigan, built on our national reputation in the areas of materials physics, atomic and molecular physics, and remote sensing physics/astrophysics, and our advocacy for the unity of instructional and research activities.

Educational Objectives

In addition to providing a strong underlying foundation in the principles of physics for virtually all students at MTU, the physics department also offers undergraduate degrees in physics and applied physics.

For those students pursuing careers in secondary education, a secondary education option is also included. Minors in physics and astrophysics are also available. In each case, emphasis is placed on both the understanding of basic concepts and physical rules, as well as the student’s ability to solve related problems.

The BS program in physics provides a solid base in the physical sciences, mathematics, and humanities designed for students planning to pursue additional study in physics at the graduate level. The junior and senior years provide an intensive and integrated study of both theoretical and experimental physics.

Students who major in applied physics receive a rigorous program in physics with the provision for a cross-disciplinary area of concentration in another branch of science or engineering. Examples include minor programs in astrophysics, remote-sensing physics, mechanical engineering, and numerous other areas based on the individual needs of the student. Graduates seek employment in careers that feature interdisciplinary training or may continue to graduate school in physics or their minor area to achieve an outstanding interdisciplinary education.

Graduate Programs

The physics department offers both an MS and PhD in Physics, with principle areas of concentration in materials physics, atomic and molecular physics, astronomy and astrophysics, as well as atmospheric physics. Research groups include theorists, computationalists, and experimentalists. For more information on our research and educational programs, please see our Web site <www.phy.mtu.edu>.

Emphasis in the graduate program is on the PhD, which is designed to educate scientists who are capable of conducting independent research and training other scientists. Course work for both the PhD and MS is taken in the areas of classical mechanics, electrodynamics, mathematical physics, quantum mechanics, statistical mechanics, thermodynamics, atmospheric physics, and astrophysics. For more information, refer to the current Graduate School Bulletin.

All students seeking to study physics are urged to carefully examine the physics department Web page <www.phy.mtu.edu>, where detailed descriptions of all programs and each faculty’s research may be found.

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Undergraduate Programs
Liberal Arts, BA
- History
- Social Sciences, BS
  - General
  - Pre-Law
  - Secondary Education
Minors
- American Studies
- Historical Studies
- Environmental Studies
- International Studies
- Social and Behavioral Studies

Graduate Programs
- Environmental Policy, MS
- Industrial Archeology, MS

Social Sciences

In various ways, the different social sciences study the behavior and interaction of individuals, groups, societies, and nations. Social scientists apply a systematic, scientific approach to analyze human behavior, social values, and institutions. Specialties range from psychology to political science to archaeology.

Needed Background
Take a wide variety of courses in high school. Besides a good dose of the various social studies (history, government, geography, economics), students should take courses that develop good writing, analytical, and communications skills. Students should also get a solid background in mathematical and natural sciences to develop their scientific and quantitative skills.

Career Options
Careers requiring a foundation in the social sciences include city and regional planning and development, public administration, market research, personnel relations, counseling and related mental-health professions, and diplomatic affairs. A social sciences degree is also excellent preparation for law school.

About half of Michigan Tech's social sciences graduates pursue graduate studies; others obtain employment in government service, personnel administration, law firms, libraries, and educational institutions.

Social Sciences at MTU

The Department of Social Sciences contains seven major disciplines: anthropology, archaeology, geography, history, political science, sociology, and STS (science and technology studies).
The Department of Social Sciences at Michigan Tech is rather unique in that most of its faculty have research or teaching interests in how science and technology interact with society. For example, the department's two graduate programs—industrial archaeology and environmental policy—provide a social science component to Michigan Tech's traditional strength in science and technology education.

Faculty in the department have long combined good teaching with solid research. Nearly ninety percent of the faculty have published books and several have been nationally recognized for their research, winning the Norton Prize of the Society for Industrial Archaeology, the Usher Prize of the Society for the History of Technology, and the Great Lakes History Prize, among others.

Department Facilities

The Department of Social Sciences conducts a yearly field archaeological program that engages undergraduate students in basic research projects in Michigan and elsewhere.

Undergraduate students have the opportunity to learn field and laboratory archaeological research techniques assisted by cutting-edge technologies. On campus, our up-to-date archaeological research facility includes a geographic information systems (GIS)-oriented computer lab, an artifact processing and analytical lab, and a curation facility where archaeological collections are preserved and studied. The department shares remote sensing equipment with the Department of Geological Engineering and Sciences.

Graduate Programs

The department offers two master's programs: industrial archaeology and environmental policy.

Industrial archaeology combines the study of historical archaeology and the history of technology. It trains students in the discovery, interpretation, recording, study, and preservation of industrial systems and their remains. Michigan Tech's program is one of only a handful of industrial archeology programs in the nation.

Environmental policy provides students with the background needed to develop, evaluate, implement, and manage environmental policies and programs. It stresses the need for competency on the part of environmental professionals in dealing with both social and technical issues.

Mission

The Department of Social Sciences has a fourfold mission to

- broaden and enhance undergraduate science and engineering education;
- offer quality undergraduate, degree-granting programs in history and the social sciences, including social studies secondary education and pre-law;
- offer small, high quality graduate programs in areas related to the university's focus on science, technology, and the environment;
- serve as a community of professionally-active scholars who contribute to the growth of knowledge.

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The University
Programs for Everyone

Certificate Programs
Certificates can be obtained concurrently while working toward a degree or can be obtained by part-time students who are not pursuing other educational credentials. All students must, however, comply with the procedures for admission to Michigan Tech. For more information, contact the respective department or school. The following certificates are offered at MTU:

- Design Engineering (ME-EM)
- Industrial Forestry (SFWP and SBE)
- International Business (School of Business and Economics)
- Media (Humanities)
- Mine Environmental Engineering (Mining)
- Modern Languages, Literatures, and Area Study (Humanities)
- Writing (Humanities)

Certificates of Language Proficiency (Dept. of Humanities)
- Certificat Pratique de la Chambre de Commerce de Paris—Certifies French proficiency that is adequate for business.
- Zertifikat Deutsch—Certifies German proficiency that is adequate for work.
- Zentrale Mittelstufenprüfung*—Certifies German proficiency that is adequate for university work.
- Prüfung Wirtschaftsdeutsch International*—Certifies German proficiency that is adequate for business.
*Tests for these certificates are provided through the Goethe Institute and are recognized worldwide.

Cooperative Education (Co-op)
www.ucc.mtu.edu/coop.asp
Michigan Tech encourages academically qualified students to participate in cooperative education. The goal of the Cooperative Education Program at Michigan Tech is practical experience for the student before graduation. It is a joint venture between the University and a selected employer for each student. Work assignments are related to the student’s major field of study and are varied to provide a range of training and experience.

Technical level and degree of complexity of work assignments are tailored to match the level of the student’s training, progressing with each work assignment. Since the co-op student must complete essentially the same academic program as a non co-op student, the co-op student defers graduation by as much as a full calendar year.

To begin the first work assignment, a student must have completed the freshman year. Transfer students must complete at least one semester in residence at Michigan Tech. Students in the program are expected to maintain a grade point average of 2.20 or better. In the normal course of a complete cooperative education program, a student will complete from two to four semester of work assignments before graduation. Each semester of co-op carries two academic credits, six or more of which can be applied toward an academic degree, depending on the degree granting department.

The Cooperative Education Program offers several options designed to accommodate the needs of the employer and the student. Students are normally engaged in pairs, with one student at work while an alternate is enrolled on campus. A normal co-op period is usually two semesters in length, but arrangements for alternating three-month assignments are commonly made.

More than 300 students participate in the program each year, employed by more than 100 companies or organizations in the United States with which Michigan Tech has a cooperative education agreement. Although a majority of students choose to co-op in the Midwest, students have been placed in all areas of the nation. On rare occasions, students have been placed in foreign countries. For more information, go to the University Career Center or your academic department.

Degrees
Associate in Applied Science (2 year)
- Chemical Engineering Technology
- Civil Engineering Technology
- Electrical Engineering Technology
- Electromechanical Engineering Technology
- Forest Technology

Associate in Humanities (2 year)

Bachelor of Science (4 year)
- Applied Ecology and Environmental Sciences
- Applied Geophysics
- Applied Physics
- Biological Sciences
- Biomedical Engineering
- Business Administration
- Chemical Engineering
- Chemistry
- Civil Engineering
- Clinical Laboratory Science
- Computer Engineering
- Computer Science
- Economics
- Electrical Engineering
- Engineering (interdisciplinary or special focus)
- Manufacturing
- Mechanical Design
- Engineering Technology
- Environmental Engineering
- Forestry
- Geological Engineering
- Geology
- Mathematics
- Materials Science and Engineering
- Mechanical Engineering
- Mining Engineering
- Physics
- Scientific and Technical Communication
- Social Sciences
- Surveying

Bachelor of Arts (4 year)
- Liberal Arts
- Scientific and Technical Communication

Master of Engineering

Master of Science
- Biological Sciences
- Chemical Engineering
- Chemistry
- Civil Engineering
- Computer Science
- Electrical Engineering
- Engineering Mechanics
- Environmental Engineering
- Environmental Engineering Science
- Environmental Policy
- Forestry
• Geological Engineering
• Geology
• Geophysics
• Industrial Archaeology
• Materials Science and Engineering
• Mathematics
• Mechanical Engineering
• Mineral Economics
• Mining Engineering
• Physics
• Rhetoric and Technical Communication

Doctor of Philosophy
• Biological Sciences
• Chemical Engineering
• Chemistry
• Civil Engineering
• Electrical Engineering
• Engineering (nondepartmental)
  Computational Science and Engineering
  Environmental Engineering
  Propulsion Systems Engineering
• Forest Science
• Geological Engineering
• Geology
• Materials Science and Engineering
• Mathematical Sciences
• Mechanical Engineering/Engineering Mechanics
• Mining Engineering
• Physics
• Rhetoric and Technical Communication

Double Major

Students may qualify for two majors within a single bachelor's degree by completing all requirements for both majors. The student must identify one major as primary and the other as secondary by filing a Change/Addition of Major or Minor form with CSRR. Both majors will be recorded on the student's diploma and transcript, and both will appear in the commencement program.

Student anticipating double majors are encouraged to work with academic advisors in both major departments so that course selection and sequencing can be coordinated. Students in curricula with few elective credits or for whom completing the requirements for a double major may require 32 or more additional credits should consider a dual-degree program that would result in the award of two, distinct bachelor's degrees.

Dual Degrees

A student who has a BS degree from an accredited institution of higher education or is pursuing dual bachelor's degrees may obtain a second bachelor's degree from MTU by earning a minimum of 25 percent of the credits required for the second degree. The department recommending the candidate for the second degree has the final authority in determining the courses necessary for that degree.

The student must file a second or dual-degree declaration form with the advisor in the second-degree department no later than the first week of enrollment for that degree. Forms are available from the academic departments and Degree Services.

Michigan Tech has formal dual-degree programs in
• Engineering with Adrian College, Albion College, Augsburg College, College of St. Scholastica, Mount Senario College, Olivet College, Northland College, and the University of Wisconsin–Superior.
• Forestry with Mount Senario College, Northland College, and the University of Wisconsin–Superior.

Upon completing the academic requirements of the two cooperating institutions, the student is awarded two BS degrees—one from the liberal arts institution and one from MTU. Transfer student admission policies also apply to students who participate in any of the dual degree programs.

Dual Enrollment: 1+1 or 2+2

MTU has agreements with the following institutions that allow dual enrollment: Lansing Community College, Delta College, Gogebic Community College, Northwestern Michigan College.

An undergraduate may enroll in both institutions, complete the required courses at the home institution, and automatically become either sophomores or juniors at MTU.

To be considered for the program, students must have successfully completed the high school courses listed in the “Entrance Requirements” chart, page 125, and meet the general home institution admission requirements. Get additional information from the admissions offices of the dual institutions.

Extended University Programs

www.admin.mtu.edu/eup

Michigan Tech promotes knowledge enrichment and personal development through credit courses and programs as well as noncredit courses and seminars offered via distance delivery technologies to individuals and corporate sponsors. The office of Extended University Programs facilitates the organization and delivery of MTU distance learning programs. Currently all distance programs are site specific. The BSE, MSME and PhD degree programs are only available through corporate sponsorship. Delivery methods available include satellite, videotape, videoconferencing, and video streaming.

Michigan Tech is linked with several consortia that provide distance education courses to major industries and to students throughout the world. These include the Association for Media-Based Continuing Education for Engineers (AMCEE), National Technological University (NTU), and the Michigan Virtual University. Only the upper-division courses (3000–4000) are provided by MTU. Students will complete and transfer lower-division credits from an accredited college or university.

Undergraduate programs offered at a distance include

• BS in Engineering—(120 cr) The degree program is accredited by the Accreditation Board for Engineering and Technology (ABET). Offered through the Department of Mechanical Engg–Engg Mechanics, the BSE program is designed to provide a sound foundation in mathematics, basic sciences, engineering sciences, communications, and general education with concentration areas available in mechanical design or manufacturing.

• BS in Surveying—(120 cr) Offered through the MTU School of Technology, the BSS program prepares students for the Michigan surveyors licensing examination by requiring a core of basic science, math, and surveying courses followed by advanced surveying courses that focus on application of principles. The BSS is accredited by the Related Accrediting Commission of the Accreditation for Engineering and Technology (RAC of ABET).

MS or PhD programs are offered as well in mechanical or electrical engineering. Please contact EUP for more information on any of these programs: 1-800-405-4678 or disted@mtu.edu.

International Education—Study Abroad

www.mtu.edu/cie

Beginning in 2000–01, Michigan Tech students can choose from five new Tech sponsored programs for a semester or year in Australia, Scotland, Mexico, Finland and Switzerland. Through our other partnerships, students can also study in Japan, Germany, Italy, Spain,
France, Norway, Sweden, Hungary, Morocco, Turkey, Malaysia, China, India and hundreds of other sites around the world. Most of these programs cost about the same as a semester at Tech and your financial aid can be applied to Michigan Tech approved programs. Many of the programs include course instruction in English so that you don’t have to worry about a language barrier. Finally the Center for International Education will work with you to make sure that your credits transfer back for graduation.

In addition to semester and year programs, CIE offers students a growing number of very affordable three- to six-week summer study programs in exciting places around the world. Most of these programs are led by Michigan Tech faculty and include a specialized course in your major plus a language and culture course. Both courses will count towards your graduation. For example, this year we have students studying archeology in England, business in France, forestry in Mexico, and mechanical engineering in Germany.

With international experience being valued more and more by employers today in our global workplace, you can’t afford not to take advantage of these opportunities. Plan ahead and stop by the CIE for more information.

**MICUP Transfer Degree Program**

The MICUP Transfer Degree Program is available to Native American students who wish to transfer to Michigan Tech from Gogebic Community College, Bay de Noc Community College, and Northwestern Community College.

Options include Michigan Tech’s Summer Experiences. Students can work with Youth Programs as a residence counselor or work with faculty on research in the department in which they intend to transfer. They can earn credits toward a degree in their field of interest. A work stipend, tuition for a course, room, and meal allowance are provided. For more information, contact coordinator, Native American Outreach, Educational Opportunity Office.

**Minors**

Michigan Tech offers minors in a variety of disciplinary and interdisciplinary specializations. A typical minor consists of 16–20 credits of course work. At least 6 credits must be at the 3000 or 4000 level, and these may not be courses specifically required for the student’s major.

Many students will be able to complete minors by using free electives, by adding a course during a few semesters, and/or by attending summer session. Please check with the sponsoring department (listed in parentheses) for specific requirements. A student will declare a minor by filing a Change/Addition of Major or Minor form with the OSIR.

- Aerospace Studies (Air Force)
- American Studies (Social Sciences)
- Art (Fine Arts)
- Astrophysics (Physics)
- Biochemistry (Biological Sciences)
- Biological Sciences (Biological Sciences)
- Chemistry (Chemistry)
- Communication Studies (Humanities)
- Computer Science (Computer Science)
- Earth Sciences (Geological Engineering and Sciences)
- Ecology (Bio Sci/SWP)
- Economics (SBE)
- Electronic Materials (Materials Science and Engg)
- Environmental Studies (Social Sciences)
- Ethics and Philosophy (Humanities)
- Geological Engg (Geological Engineering and Sciences)
- Historical Studies (Social Sciences)
- International Studies (Social Sciences)
- Journalism (Humanities)
- Mathematical Sciences (Mathematical Sciences)
- Microbiology (Biological Sciences)
- Military Arts and Science (Army)*
- Mineral Processing (Materials Sci and Engg)
- Mining (Mining Engineering)
- Music (Fine Arts)
- Physics (Physics)
- Plant Biotechnology (Bio Sci/SWP)
- Plant Sciences (Bio Sci/SWP)
- Speech Presentation (Fine Arts)
- Psychology (Education)
- Remote Sensing (Geological Engg and Sciences)
- Social and Behavioral Studies (Social Sciences)
- Structural Materials (Materials Sci and Engg)
- Technical Theatre (Fine Arts)
- Theatre Arts (Fine Arts)
- Wood Science (SWP)

*Not available until academic year 2001–02

**Officers’ Training (ROTC)**

<www.aux.mtu.edu/afrotc> or <www.aux.mtu.edu/armyrotc>

The Reserve Officers’ Training Corps (Army or Air Force) is open to all US citizens enrolled at Michigan Tech. Students may enroll in Army (AR) or Air Force (AF) courses during the first two years with no obligation to the service. ROTC scholarship students become obligated to their respective service at the beginning of their sophomore year. Students completing either program may receive a commission as an officer in the US Army or Air Force. See pp. 85–87 for more information.

**Preprofessional Programs**

Many different majors and courses of study can lead to successful admissions to professional schools after the bachelor’s degree. Admission requirements of various professional institutions vary; therefore, it is the student’s responsibility to determine if a suggested program at MTU meets the admission requirements of a particular college with professional programs. Students should consult with their advisors for courses of study.

Two advisors are specially trained to work with students pursuing professional careers in medicine and related health sciences, and in law. The premedical advisor, located in the Department of Biological Sciences, helps students prepare for admission to schools of medicine, dentistry, optometry, pharmacy, physical therapy, podiatry, veterinary medicine, and other health professions. The prelaw advisor works specifically with students pursuing careers in law.

Contact the Office of Admissions for current information regarding the premedicine and prelaw advisors.

**Secondary Teacher Certification**

www.ed.mtu.edu

Specific major and minor programs are available leading to secondary school teacher certification and a bachelor’s degree in the following certification areas. For more information, see Department of Education and degree requirements for specific programs.

- Biology (BS in Biology or Clinical Laboratory Science)
- Chemistry (BS in Chemistry)
- Computer Science (BS in Computer Science)
- Earth Science (BS in Geology)
- English (BA in Liberal Arts)
- General Science (BS in Applied Ecol & Envir Science)
- Physical Science (BS in Engineering)
- Mathematics (BS in Mathematics)
- Physics (BS in Physics)
- Social Studies (BS in Social Sciences)
Admissions—Getting In

Application Procedure
www.admin.mtu.edu/em/stumarket/Admissions.html

Read important general information below regarding freshman, transfer, international, and other types of student admission.

1. Complete Michigan Tech Application for Admission any time after June 1 preceding the academic year for which you plan to enroll.
2. Attach $30 nonrefundable application fee (check or money order) made payable to Michigan Technological University.
3. Freshmen: Submit application and fee to high school counselor or principal.
4. Transfers: Submit application, official transcripts, and fee to MTU Admissions Office.

Application Criteria—Michigan Tech operates a selective admissions policy. The University admits only applicants who give definite evidence that they are qualified through education, academic fitness, aptitudes, interests, and character to complete the University's requirements.

Once students are accepted for admission, every effort is made by the faculty and staff to help students realize their potential.

Acceptance Packet—Upon acceptance by MTU, students receive an acceptance packet containing, among other information, the following:
- acceptance letter
- information regarding various University deadlines
- request for the enrollment deposit ($100)

General Information
The following describes the undergraduate admissions process. For information on graduate admissions, refer to the current Graduate School Bulletin.

Application Forms—Forms may be obtained from the MTU Admissions Office or online.

Credentials—Submit credentials at least thirty days before the beginning of the semester of intended enrollment. However, admission for any semester is subject to earlier closing without notice. The Application for Admission and all supporting credentials become the property of the University and will not be returned or forwarded to another institution.

Social Security Number—Your MTU identification number is your Social Security Number, which can be obtained from any Social Security Administration office. Although submitting this number is voluntary, it is required of applicants for federally funded financial aid.

Test Scores—Scores from the Preliminary Scholastic Assessment Test (PSAT), the Scholastic Assessment Tests (SAT), and the American College Test (ACT) are used by MTU for admission, financial aid, counseling, and placement purposes. Applicants are encouraged to take one or more of these tests. Michigan Tech must be listed as a recipient of the scores. The MTU code number for the PSAT and SAT is 1464; for the ACT, it is 2030. Test registration forms are available at high school counseling offices or from the testing agency.

PSAT and SAT—College Board ATP, P.O. Box 6200, Princeton, NJ 08541-6200.
ACT—American College Testing Program, P.O. Box 168, Iowa City, IA 52243.

Advanced Placement—Students with applicable experience may be granted credit or waiver of prerequisites if they demonstrate competence in the subject matter of the course concerned through proficiency examinations approved by the head of the appropriate academic department. Each academic department makes the final determination for advanced placement within that department.

MTU encourages qualified students to participate in the Advanced Placement Program (APP) of the College Board, the International Baccalaureate Program (IB) while in high school, or the College-Level Examination Program (CLEP) prior to enrolling in college-level courses. University credit may be earned through successful performance on many APP, IB, and CLEP (subject matter) examinations. Information regarding these tests can be obtained from the student's high school or by writing to the College Board, 45 Columbus Avenue, New York, NY 10022-6992.

No student is required to accept advanced placement or follow other forms of accelerated education available at MTU.

Freshmen
Freshmen should be graduates of accredited secondary schools and must generally have above-average class standing. An applicant's secondary school curriculum should include at least 15 units of acceptable entrance credits, including the subjects required for entrance into the applicant's intended program of study (see the entrance requirements chart, next page).

A transcript of high school credit must accompany the application. Upon receipt of the application, the application fee, and transcript, the Admissions Office will send further instructions.

Transfer Students
Students in good standing who have satisfactorily completed work at another college are encouraged to apply for admission. An average of at least C (2.50 on a 4.00 scale) is generally recommended for students applying to Michigan Tech. Some high-demand curricula may require an average higher than a C for consideration. The grade point average (GPA) earned at other institutions is neither transferable nor used in computing the GPA at MTU.

Applicants who have earned an associate's or higher degree from an accredited college or university prior to the time of application are not required to submit their high school transcripts with their application for admission.

Transfer credit—Granted in accordance with the guidelines established by the academic departments.

1. Specific course credit is granted for courses taken (including correspondence courses) in which passing grades of C (1.50/4.00 scale) or higher have been obtained, provided the courses are equivalent in content, length, and prerequisites to courses offered at this University. Any correspondence course presented for transfer credit must be acceptable for residence credit in a comparable program at the college or university offering the course.
2. Unassigned credit may be granted for courses that are not comparable to those offered by this University. Such credit will apply only toward the total credits required for graduation, unless the department authorizes the use of the credit to meet academic departmental requirements. All credits granted become final only after the student has demonstrated satisfactory progress at MTU.

Community College Transfers—The MTU Admissions Office can prescribe the program of study to follow while at the community college to students who plan to transfer to Michigan Tech after completing one or more years. All of the recommended courses will transfer and apply towards the intended program of study. Admissions counselors visit most Michigan and out-of-state community colleges to provide special counseling and services.
**Entrance Requirements**

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<th>Curriculum</th>
<th>Beg. Algebra</th>
<th>Intermediate Algebra</th>
<th>Geometry</th>
<th>Trigonometry</th>
<th>Chemistry or Physics</th>
<th>Biology, Chem., or Physics</th>
<th>English</th>
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Although not required, additional units of English, mathematics, and science, and courses in social studies and modern languages are strongly recommended.

It is also recommended that students have a fourth year of college preparatory mathematics, the core of which should consist of college algebra and the study of analytic geometry, the elementary functions, limits, and like topics of a precalculus nature; other topics might include probability, statistics, permutations and combinations, mathematics induction, an introduction to the use of sets, an introduction to computers and computing, or an introduction to matrices and determinants.

**International Students**

The Center for International Education (CIE) is responsible for recruiting and supporting international students on campus. The CIE issues the I-20s and is the University's official representative for the Immigration and Naturalization Service. CIE offers airport transportation for international students upon arrival, orientation, and an extensive support structure to help our international students adapt and become integrated into the Michigan Tech community.

**Admissions Criteria**—International applicants must

- satisfy entrance requirements comparable to those required for students from the US,
- have above-average grades, and
- establish their ability to cover all of the expenses for their first year of study; employment opportunities are extremely scarce.

**Admissions Procedure**—International applicants must

1. Send a letter to the Center for International Education requesting consideration for admission six months to a year before anticipated enrollment.

You will receive an Undergraduate Application for Admission (for International Students) form and a brochure describing international student admission requirements. Information and an application form can also be acquired at our Web site [<www.mtu.edu/cie>].

2. **If your native language is not English**, take the Test of English as a Foreign Language (TOEFL) while still abroad.

A score of 173 or higher on the computer-based TOEFL generally is considered satisfactory for admission to the University.* Obtain information regarding this test from American embassies and consulates, United States education commissions and foundations abroad, and binational centers. Application for the TOEFL should be made to TOEFL/TSE Services, P.O. Box 6151, Princeton, NJ 08541-6151 USA.

3. Send certified English translations with all credentials written in another language.

* SMILE Program—Students whose TOEFL score falls slightly below MTU's minimum should consider enrolling in the SMILE (Summer Math and Intensive Language Experience) Program, which consists of mathematics courses for academic credit and intensive English language and American culture courses. Upon successful completion of the courses, you will be able to continue your studies at MTU.
Admitted International Students—An applicant is admitted to MTU only when he or she has
• fulfilled all necessary requirements;
• received an official letter of admission and has completed those documents the University requires prior to arrival on campus;
• received the Certificate of Eligibility (Form I-20) as required by immigration authorities. This form is sent to the student along with the admission letter.

Upon arrival to Michigan Tech’s campus, accepted international students must report to the Center for International Education.

Guest Students
A student who is regularly enrolled in good standing at another institution may be admitted to MTU for one semester as a guest student. A student who wishes to register for two or more consecutive semesters must apply for admission as a transfer student. A Michigan Uniform Undergraduate Guest Application form may be obtained from the Admissions Office at Michigan Tech or from any other college or university in Michigan.

Nondegree Students
People who are not candidates for a degree and who wish to apply for part-time study (carrying less than 12 hours of credit) are permitted to do so if openings are available.
Part-time, nondegree-seeking students should complete and submit an Application for Admission form to the Admissions Office, but they are not required to submit high school and college transcripts. However, if they later desire to become full-time or degree-seeking students, they must satisfy the same requirements as regularly enrolled students and receive official approval from the Admissions Office.
High school students may be admitted to specific courses on a concurrent enrollment basis provided they also receive permission from their high school principal.

Former Students (Readmission)
Any University student whose enrollment is interrupted for one or more semesters must obtain permission to reenter well in advance of the beginning of the semester for which the student wishes to reenter. In a letter, fax, or e-mail requesting permission, the student should (1) list the dates of past enrollment at the University, (2) indicate the semester for which re-enrollment is requested, and (3) give a brief chronological account of activities since last attending Michigan Tech. Official transcripts from all the schools attended and for all the credits earned since leaving the University must be submitted to the Office of Student Records and Registration.
A student who has been dismissed or requested to withdraw must obtain approval from the dean of student affairs in order to reenter the University at any time by submitting a written petition to the dean well in advance of the semester for which the student desires readmission.

Finance 101

Value
Michigan Tech is committed to providing a quality education at an affordable cost, and that commitment is reflected in our ratings as one of the “Top 10” technological universities in the nation by Money Magazine’s Money Guide and one of the top fifty “best values” among national universities by U.S. News & World Report. Michigan Tech’s comprehensive financial aid program makes our education even more affordable. Not to be overlooked in financial considerations is future earning power as an MTU graduate, which will far exceed the investment for educational expenses.

Basic Expenses
The basic estimated expenses of a full-time student living in a University residence hall for a two-semester academic year are shown below. When estimating annual University expenses, students should also allow for travel and personal expenses. While the University reserves the right to make changes in fee schedules, books, and other student charges without advance notice, every effort is made to maintain high academic standards and comfortable living facilities at the lowest possible cost to the student.

<table>
<thead>
<tr>
<th>Estimated Expenses for the 2000–01 Academic Year (for incoming freshmen*)</th>
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<tbody>
<tr>
<td>Michigan Resident</td>
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<tr>
<td>Tuition*</td>
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<tr>
<td>Consolidated fee</td>
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<tr>
<td>Computer, lab, and course fees (estimated)</td>
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<tr>
<td>Room and board</td>
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<tr>
<td>Books and supplies (estimated)</td>
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<tr>
<td>Personal needs and travel (estimated)</td>
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<tr>
<td>Total</td>
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</table>

* MTU uses a lower- and upper-division scale determined by number of credits earned. This chart reflect lower-division rates. Note that course/lab and computer access fees, books and supplies, and personal/travel needs can vary widely by individual and program.

Michigan Residency—The governing board at each university in Michigan has the authority to determine residency classification guidelines for admission and tuition purposes. Therefore, residency guidelines may vary from school to school and are independent of guidelines used by other state authorities to determine residency for purposes such as income and property tax liability, driving, and voting. A resident student is defined as a student domiciled in the State of Michigan. Dependent students must have the same residency as their parents. Independent students must have a physical presence in Michigan. Students who enroll in the University as nonresidents shall be so classified throughout their attendance as students unless residency reclassification is granted. Continuously enrolled nonresident students are not eligible for reclassification.

Students who believe their residency status has changed since their first enrollment, may seek an evaluation of their status by contacting the Office of Student Records and Registration—906-487-2319 or <www.admin.mtu.edu/em>.

MTU alumni who were Michigan residents as undergraduates will retain that residency status for tuition purposes, regardless of current address.
Payments

Billing Instructions—The fall semester registration bill is the only bill mailed to the student's home address. All other bills are mailed to the student at their campus/local address. Registration bills must be received by the due date to validate your enrollment and retain your course schedule. You must process your registration bill even if you do not owe money because your schedule is canceled if your signed registration billing statement is not received by the due date. Please allow ample time for mailing. The University accepts VISA, Mastercard, and Discover by fax, mail, or telephone. These lines are often busy during peak times. Telephone: 906-487-2247; fax 906-487-1816; Web <www.sas.it.mtu.edu/acct/dept/acctrecv/bilinstr.html>.

If financial aid is missing from your bill, contact Financial Aid. If graduate student support is missing, contact your department.

Late Payments—Students registering, paying fees, or validating billing statements after the registration period or after the posted final payment date are required to pay the amount due plus a late fee. No student registering or paying fees late may be excused from paying the late fee, nor will the fee be refunded unless there are extreme, unusual circumstances. The controller will determine eligibility for a waiver or refund, and such waivers or refunds will be at the discretion of that office.

Installment Prepayment Plan—The University offers an installment prepayment plan through Accounts Receivable whereby tuition, fees, and room and board are prepaid monthly with no finance or interest charges. If you are a new MTU student or have been enrolled in the plan the previous academic year, you will receive an application by May. If you are not new to MTU and have not been previously enrolled in the plan, contact MTU, Accounts Receivable, 1400 Townsend Drive, Houghton, MI 49931-1295; 906-487-2246 or 800-576-6484; <www.sas.it.mtu.edu/acct/dept/acctrecv/prepymt.html>.

Deferred Payment Plan—This plan requires 50 percent of the current semester charges/credits plus any past due balance plus current due rent. This balance is due in the Cashier's Office by the due date of the semester bill. The balance of the account is due with the second billing cycle of the semester (usually the end of the fifth week). A $50 fee is assessed for the Deferred Payment Plan. If you wish to participate in the Deferred Payment Plan, contact MTU, Accounts Receivable, 1400 Townsend Drive, Houghton, MI 49931-1295; 906-487-2246 or 800-576-6484; <www.sas.it.mtu.edu/acct/dept/acctrecv/prepymt.html>.

Refunds—Students will be assessed tuition according to the number of credits for which they are registered on the fifth day of instruction. The bursar will determine whether extraordinary circumstances warrant exceptions to the refund policy in individual cases. See Appendix A for complete refund or repayment policies.

The enrollment deposit is refundable within 6 months of leaving the University or applied to unpaid charges such as fines, lab fees, and other penalties.

General Information

Tuition/Fees—All charges for tuition, fees (including computer access and individual course/lab fees), and room and board are payable each semester and will be charged and due prior to the posted final payment date. Semester invoices will be prepared for all changes occurring after the initial bill.

Lab/Course and Computer Access Fees—Lab/course/computer access fees are listed in the Time Schedule Booklet. All enrolled MTU students are required to pay their academic departments a fee for basic computing. A student will be assessed a lab/course fee if required of the course and must pay the fee if the course is not dropped by the fifth day of class.

Students auditing courses will be charged the same fees as if the courses were taken for credit. Co-op students and students on internships may be exempt from the computer access fee.

Inspection Trip Fee—A service charge for students required to take certain courses involving inspection trips.

Enrollment Deposit—All accepted full-time or degree-seeking undergraduate students are required to pay a $100 enrollment deposit to reserve admission and continue enrollment at the University. It must be submitted by May 1. Applicants accepted after May 1 should send this deposit within two weeks from the date of their letter of acceptance. The enrollment deposit cannot be credited toward tuition or any other fees and is nonrefundable, except when a new student fails to enroll and, in the judgement of the director of admissions, the failure to enroll was beyond the control of the student.

Aptment Rent Payments—MTU Apartments (Danniell Heights) rent payments are due on the first of each month and payable by the fifth of each month without a penalty. Bills are not issued. The late payment fee for Danniell Heights Apartments is $10 the 6th of the month and an additional $10 if not paid on the 16th.

Financial Aid

Each admitted student is considered a candidate for all the scholarships for which he or she qualifies. Selection is made by the Scholarship Committee from the admissions application or Registrar's Office data.

All students desiring need-based financial aid awarded by the University must submit the Free Application for Federal Student Aid (FAFSA) to the federal processor with Michigan Technological University (code 002292) listed as a recipient of this analysis. All need-based aid is dependent on FAFSA results, which must be available to the Financial Aid Office. Complete the FAFSA and apply for admission by February 15. Students already enrolled should complete the FAFSA by March 1 preceding the academic year for which they are applying for financial aid.

Freshmen—Recipients of freshman awards are selected on the basis of high school class rank, national test scores, special criteria established by sponsors of scholarships, and/or financial need. To enhance eligibility, applicants should take the American College Test (ACT), the College Entrance Examination Board Scholastic Assessment Test (SAT), or the Preliminary Scholastic Assessment Test/ National Merit Scholarship Qualifying Test (PSAT/NMSQT) prior to January 1 of their senior year.

Transfer Students—Transfers must submit a financial aid transcript from each institution previously attended. Scholarships for transfer students are available primarily to current-year graduates of Michigan community colleges. Recipients of new transfer awards are selected on the basis of college academic record. The deadline is February 15 preceding the academic year in which the applicant plans to enroll at the University.

Enrolled Students—Enrolled students who indicate their intention to return for the following academic year by registering for fall classes by the set deadline are considered on a competitive basis for scholarships. Awards for enrolled, returning students are announced approximately July 1.

Scholarships/Grants

MTU offers scholarships sponsored by the University, by individuals and companies, and by local, state, and federal agencies. The following is a selected list; for a complete list of scholarships, see Appendix C.

MTU Scholar Awards—These merit-based awards are to be used for any baccalaureate curriculum are given to Michigan residents who are members of the current year's graduating class of Michigan high schools and are recommended for the award by a high school math or science teacher. The award covers full-time tuition, room and board, and a book allowance.
Board of Control Scholarships— These merit-based awards to be used for any baccalaureate curriculum are given to Michigan residents who are members of the current year’s graduating class of Michigan high schools. The amount of the award varies from $1,000 up to the value of full-time tuition.

Michigan Community College Scholarships / David H. Morgan Memorial Community College Scholarships— These merit-based awards to be used for any baccalaureate curriculum that can be continued at MTU at the junior level are given to Michigan residents who are members of the current year’s graduating class of Michigan community colleges. The amount of the award varies from $1,000 up to the value of full-time tuition.

MTU Merit Scholarships— These merit- and need-based awards to be used for any baccalaureate curriculum are given to U.S. citizens who are members of the current year’s high school graduating class, and who are National Merit Scholarship Qualifying Test Finalists. MTU must be listed as the first-choice university with National Merit Corporation. The value is variable from $1,000 to $2,000.

Minority Academic Scholarships/Grants— These merit-based awards to be used for any degree curriculum are given to U.S. citizens who are members of underrepresented minority groups. The value varies from $1,000 up to the value of full-time tuition, room and board, matriculation fees, and a book allowance.

United States Scholarships— These merit-based awards to be used for any degree curriculum are given to U.S. citizens and residents of any state or territory except Michigan who are members of the current year’s high school graduating class and provides an annual scholarship that pays the difference between resident and non-resident rates.

International Student Scholarships— These merit-based awards to be used for any degree curriculum are given to citizens or residents of any country except the USA and are valued at $1,000. Accepted international students must obtain an application from the MTU Center for International Studies.

Academic Excellence Award— These merit-based awards to be used for any degree curriculum are given to non-Michigan residents who are members of the current year’s high school graduating class. To qualify, students must be in the top 25 percent of their high school class. It provides an award equivalent to the difference between resident and non-resident tuition rates.

University Student Award— This program is designed to provide financial assistance to both incoming students and currently enrolled students at MTU, based on academic potential and financial need. The amount of each award is variable, depending on need, up to the amount of full tuition for Michigan residents and the difference between Michigan resident tuition and nonresident tuition for students paying nonresident rates. Recipients of this award must attend full time, reapply each year, and meet the required minimum 2.00 cumulative GPA.

ROTC Scholarships— The US Air Force offers 2 to 5 year scholarships for students who qualify for an Air Force commission. Scholarships range from $3,000 per year up to full tuition and lab fees. Scholarship students also receive $460 per year for books and a $200 per month tax-free allowance. High school students must apply for the scholarship by December 1 of their senior year. Interested college students may apply at any time. Interested students should contact the department at 906-487-2652.

The US Army offers 4-year, 3-year, and 2-year scholarships. These scholarships are based on student abilities and potential, not financial need. The Army will pay up to $16,000 per year for tuition, incidentals, and laboratory fees. Scholarship students also receive $450 per year for books and a $200 tax-free subsistence allowance per month in school. High school students must apply for four-year scholarships by November 15th of their senior year. College students must apply for 2- or 3-year scholarships before March 1st. Contact the department at 906-487-2650.

Michigan Competitive Scholarships— These scholarships range in value from $100 to $1,250. Applicants must have (1) been continuous residents of Michigan for one year; (2) taken the American College Test (ACT) by October of their senior year of high school (or earlier) and attained a qualifying score; (3) not attended a postsecondary educational institution following high school and prior to the ACT; (4) complied with all regulations of the Michigan Higher Education Assistance Authority; and (5) demonstrated financial need through a need-analysis form (such as the FAFSA). Students must meet the satisfactory progress requirements of this program.

Other Aid Programs

To be considered for these programs, students must submit the Free Application for Federal Student Aid (FAFSA).

Federal Pell Grants— All undergraduate financial aid applicants are required to apply for federal Pell Grants each year. These grants are gift assistance to help students pay educational expenses, ranging in value from $400 to $3,300.

Federal Supplemental Educational Opportunity Grants (SEOG)— These grants are gift assistance provided by the federal government to assist undergraduates with exceptional financial need.

Michigan Educational Opportunity Grant (MEOG)— Students may be eligible for up to $1,000 per year. They must be enrolled on at least a half-time basis and demonstrate financial need.

Michigan Adult Part-Time Grant— Michigan residents with financial need who have graduated from high school at least two years prior to applying and will attend the University part-time (3-11 credit hours) can be eligible for this aid program.

TECHCIAID Student Loans— The University has need-based loan funds available to qualified students who are enrolled at least half-time. Loans will be determined on the basis of need.

Federal Perkins Loans— These need-based loans are provided by federal and University funds. Undergraduate students may borrow up to a cumulative maximum of $20,000. Interest does not accumulate until repayment period begins. Deferment of repayment is permitted for certain kinds of federal and volunteer service.

Federal Stafford Loans— Students may be eligible for a student loan from the William D. Ford Federal Direct Loan. The FAFSA or FAFSA renewal form is the only application form needed.

Federal PLUS Loans— These loans are available to parents to pay the educational costs of their dependent students enrolled at least half-time.

Work-Study Programs: Federal and Michigan— These programs provide financial assistance through employment on campus. Every effort is made to place students in jobs related to their skills, interests, and field of study. Work-Study participants generally are employed between eight and fifteen hours per week. Money awarded for a Work-Study job will be paid through biweekly paychecks.

Veteran’s Administration Education Benefits— Various programs are available for veterans, reservists, and their dependents. Information and applications can be obtained from state veteran’s affairs offices or the coordinator for veteran’s affairs at Michigan Tech.

National Guard Programs— Obtain information about various programs from state education offices.

Vocational Rehabilitation Educational Benefits— Financial assistance is available on a need basis to students with physical or mental disabilities resulting in an impediment to employment. Information can be obtained from state rehabilitation offices.

Bureau of Indian Affairs Program— Financial assistance based on financial need is available to students who are qualified Native Americans. Students should contact their tribal education office for application procedures.
Keeping Your Aid

Required Credits for Assistance—Each semester at the end of the open enrollment period, students must be enrolled in the number of credit hours listed below to receive the full value of their awards.

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<tr>
<td>Scholarships</td>
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<td>Federal Perkins Loan</td>
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<td>Federal SEOG</td>
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<td>Federal Pell Grant</td>
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<tr>
<td>Full grant</td>
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<tr>
<td>Three-quarter-time</td>
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<td>Half-time grant</td>
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<td>6–8</td>
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<td>Less than half-time</td>
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<td>1–5</td>
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<tr>
<td>University Student Award</td>
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<td>12</td>
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<tr>
<td>Michigan Competitive Scholarship</td>
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<td>12</td>
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</tbody>
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* Students carrying 6–11 credits may receive a reduced MCS award.


At Michigan Tech, in order to maintain consistency, there is a policy with minimum requirement for financial aid; however, there may be some types of aid (e.g., scholarships) with more stringent requirements: See Appendix B for details.

Academic Policies & Procedures

Academic Advancement

Credits—Academic advancement is measured in terms of semester-hour credits or, simply, credits. The number of credits required for the bachelor’s degree, which varies among departments, averages about 130 semester credits. Students may receive an undergraduate degree in approximately 8 semesters, depending on their semester course load and degree requirements.

Class Standing—Determined by number of credit hours

- Freshman 0–29 credits
- Sophomore 30–59 credits
- Junior 60–89 credits
- Senior 90 + credits

Full-Time Load—Defined as 12–18 credits per semester. When deciding the pace of academic advancement, students should consider their cumulative course work load as well as number of credit hours. Two hours of outside preparation are expected for each hour of lecture and recitation. A student in a 4-credit class would be expected to spend eight hours weekly in outside preparation.

Maximum Credit Load—The maximum load a student may carry will be subject to the following limits:

1. The student load is prescribed under individual departmental curricula; the maximum is 18 credits per semester, exclusive of ROTC, performing arts, and physical education.
2. A student with a 3.00 cumulative grade point average may be permitted to take additional credits with the approval of the student’s academic advisor.
3. A student on academic probation shall not be permitted to register for more than 16 credits per semester, excluding ROTC, performing arts, and physical education, unless approval is granted by the dean of student affairs.

Academic Work

Attendance—Students are expected to attend all classes, including recitation and laboratory sessions, beginning on the first day of regular instruction as stated in the University Academic Calendar. The University shall not schedule, nor shall the student participate in, any official function during the scheduled final examination period. Events scheduled on dates that are out of University control are exempted.

Absences—If possible, students should contact the instructor prior to the absence and arrange a mutually acceptable make-up procedure. Otherwise, students should account for the absence at the first opportunity. Students who are unable to notify instructors concerning their absence from class or who must notify several instructors on short notice, should contact the Office of Student Affairs. Students having excused absences, as defined in the MTU Student Handbook, “Attendance Policy,” are permitted to make up graded work.

Academic Integrity—Students who cheat, plagiarize, or fabricate data as well as students who help others cheat, plagiarize, or fabricate can receive sanctions ranging from warning to special failing grade to expulsion from the University, depending on the severity of the offense. See the MTU Student Handbook or the Academic Integrity Policy <www.admin.mtu.edu/dos/acadinteg1.htm>.

Individual Efforts—The University expects that students’ work on individual assignments and examinations will be their own private efforts that will follow acceptable practices. While group efforts and study groups are often appropriate and acceptable, students are expected to submit their own work. At times, it is difficult to differentiate between legal study aids and illegal “scoop.” When in doubt, confer with the course instructor.

Weather Closure Policy—The president, senior vice president/provost, or their designated representative may decide to declare University closure for a specified period of time (examples might include but are not limited to prolonged power outage, prolonged loss of heating capability, or closure of main highway due to inclement weather). Notification will be through local media. Faculty and students will be excused from reporting to class.

Academic Preparation

Advising

www.admin.mtu.edu/dos/advising

Upon enrolling, students are assigned academic advisors by their major departments. Students are urged to consult their advisors on all academic concerns.

Learning Centers

www.mtu.edu/learn.html

In recognition that the mind does not develop in isolation but as a result of our interactions with others, MTU has many learning centers offering peer and professional academic coaching through weekly appointments, team learning groups, and walk-in tutoring for the following areas: biological sciences, chemistry, computer science, electrical and computer engineering, engineering, mathematics, physics, and writing.

Orientation

Each new student at MTU is required to participate in the orientation program, which helps students adjust to campus and community life and to familiarize themselves with the University. During orientation, new students have opportunities to (1) meet with academic advisors and faculty to discuss curriculum requirements; (2) learn about University policies, resources, services, and extracurricular activities; and (3) tour campus facilities and meet with representatives from various departments; (4) become familiar with their new community; (5) attend programs regarding life skills as well as academic concerns.
Summer Preparatory Program: MaCH-1

MaCH-1 is a six-week summer program offering math, chemistry, English, and/or PE for college credit to students who will be entering college the following fall. Participants are placed into a math course based on their ACT scores, providing the necessary background for a rigorous, university-level science or engineering program. Week-long precalculus workshops are also offered. With small classes, frequent one-on-one tutoring, and seminars on college life, MaCH-1 offers 4–9 credits, gives students an opportunity to refresh mathematics skills or complete prerequisite courses, experience college life in a relaxed environment, and develop confidence in their abilities.

Academic Standing

It is the responsibility of students to stay informed about their academic standing at all times. The academic progress of degree-seeking undergraduate students is monitored.

Good Academic Standing

A student is in good academic standing when all of the following are true:

1. The University cumulative GPA is 2.00 or greater.
2. The GPA for the most recent semester is 2.00 or greater.
3. The cumulative GPA in the major department is 2.00 or greater.

Dean's List—Full-time (12 or more credits) undergraduate students who earn a GPA of 3.50 or higher in any semester are placed on the Dean's List, which is released to hometown newspapers and posted in the Office of Student Affairs. Dean's List status is recorded on the students' transcripts. Students who earn a GPA of 4.00 in any semester receive a letter congratulating them on this achievement. Parents or guardians of students with a 4.00 GPA are congratulated for their role in the student’s success.

Graduation with Honors*—Graduating students who have earned associate or bachelor’s degrees and who have superior academic records are recognized on the commencement program and diploma. Commencement program designation is based on the student’s cumulative GPA at the end of the semester preceding the final semester in attendance; diploma designation is based on the student’s cumulative GPA through completion of all degree requirements.

- cum laude 3.50–3.69 GPA
- magna cum laude 3.70–3.89 GPA
- summa cum laude 3.9+ GPA

* These new standards apply to full-time (12 or more credits), degree-seeking undergraduate students who will matriculate in fall 2000 or later. Currently enrolled students who matriculated before fall 2000 will follow the standards as listed in the 1997–99 MTU Undergraduate Catalog.

Academic Difficulty

Students having academic difficulty may be asked to withdraw from specific courses, be placed on academic probation, or be academically dismissed.

Required Course Withdrawal—The dean of student affairs may, on the recommendation of the department chair, require students to withdraw from any course or courses in which their preparation, progress, effort, or conduct is deemed unsatisfactory.

Academic Probation—Students who are not making satisfactory progress toward a degree are placed on academic probation. Academic probation is a strong warning to students that their scholastic performance is less than that expected by the University. Notices of academic probation are sent to students at the same time grades are available at the end of the semester. Failure to improve after receiving a probation notice can result in academic dismissal from the University (see below).

A student seeking an undergraduate degree is placed on academic probation when any of the following is true:

1. The University cumulative GPA is below 2.00.
2. The GPA for the most recent semester is below 2.00.
3. The cumulative departmental GPA is below 2.00, based on at least 16 credits.

A student on academic probation will be removed from probation when all of the following are true:

1. The University cumulative GPA is 2.00 or greater.
2. The GPA for the most recently completed semester is 2.00 or greater.
3. The cumulative departmental GPA is 2.00 or greater, based on at least 16 credits.

Academic Dismissal—A student is eligible for academic dismissal if the student meets the academic probation criteria for two consecutive semesters, or has zero earned credits in a semester, or has a GPA below 1.00 in a semester. A student receiving a notice of academic dismissal will not be permitted to enroll at the University.

Appeals of Academic Dismissal—Appeals will be heard if students can document that there are unusual or extenuating circumstances surrounding their recent academic performance. The student and her parents or guardians of the student will be notified of the date of appeal and asked to attend the meeting. The catalog secretary will act as chairperson of the appeals committee.

Reinstatement—A student dismissed for unsatisfactory academic progress may apply for reinstatement through a written request to the dean of student affairs after a period of nonenrollment. A student who is reinstated after academic dismissal will be reinstated on academic probation and shall be considered as having enrolled under the catalog and curriculum in effect at the time of reinstatement. Failure to achieve good academic standing or show substantial academic progress by the end of one semester of attendance will result in permanent academic dismissal.

Conduct

www.admin.mtu.edu/dos/policies.htm

All members of the University community—students, faculty, staff, and administrative officers—are jointly involved in maintaining a moral and social pattern in keeping with acceptable conduct as found among educated persons. Students are expected to exhibit behavior which is indicative of good citizenship and to accept personal responsibility for their conduct that may be incongruent with University community standards. The University reserves the right to discipline any student for violation of any rule, ordinance, or law, or for any conduct damaging to the University, by such means as it considers suitable, including dismissal. Refer to the MTU Student Handbook, “Student Rights and Responsibilities in the University Community” section, and the Academic Integrity at MTU guide for more information on disciplinary procedures and specific policies.

Sex Discrimination/Sexual Harassment—Michigan Tech must provide a fair and responsible environment for all of its students. Federal and state law prohibit discrimination in the use of educational facilities because of gender. Discriminatory treatment on the basis of one’s status as cited in the Michigan Tech Equal Opportunity statement is prohibited. Title VII of the Civil Rights Act expressly prohibits sexual harassment. According to the MTU Sexual Harassment Policy,
unwelcome sexual advances, requests for sexual favors, and other verbal and physical conduct of a sexual nature constitute sexual harassment when submission is either explicitly or implicitly a basis for academic advancement (e.g., for better grades, advancement in an academic program); or submission or rejection affects the targeted person's employment (e.g., their evaluation, advancement, salary); or the conduct has the purpose or effect of unreasonably interfering with the targeted person's work performance or learning environment; or it creates an intimidating, hostile, or offensive work, academic, or residential living environment. For information on the University's sexual discrimination policies, see the MTU Student Handbook, "Student Rights and Responsibilities in the University Community" section or contact the offices of Affirmative Programs or Student Affairs.

Substance Abuse—The University encourages and promotes an environment where healthy life-style choices can be made every day by the students, faculty, and staff. Students may take advantage of the substance abuse assessment and counseling available to them through Counseling Services. MTU is committed to following the guidelines of the Drug-Free Schools and Community Act of 1988.

MTU recognizes that substance abuse has a detrimental effect on the University's goals and objectives. It affects the intellectual, social, physical, and moral growth and development of the individual and the campus community. To reduce the effects that substance abuse promotes, Michigan Tech expects each person to accept the responsibility for their own choices and behavior. The University will intervene in any substance abuse-related behaviors that have a negative effect on any segment of the University community or violate any city, state, or federal law. For specific drug and alcohol policies, see <www.sas.it.mtu.edu/psafe/2000crime-report.html#3>.

Disabilities (ADA)

MTU complies with all federal and state laws and regulations regarding discrimination, including the Americans with Disabilities Act of 1990 (ADA). Michigan Tech is committed to a policy of educating individuals with physical or learning disabilities without discrimination. Students with documented disabilities should contact the Student Affairs Office for assistance and accommodations. It is the student's responsibility to inform the Office of Student Affairs of their class schedule for each semester in which accommodations are sought.

General Education

The basic general education curriculum consists of four parts: (1) a set of four core courses to be taken by every baccalaureate student at MTU (13 credits), (2) a five-course distribution requirement (15 credits), (3) a three-unit requirement of co-curricular activities (currently physical education), and (4) a science/math requirement (16 credits).

The core courses are designed to promote active engagement in learning, coherence within the curriculum, integration within and across disciplines, and development of university-level habits of mind. The core courses are UN 1001 Perspectives on Inquiry, an interdisciplinary seminar taken in the first semester of the first year; UN 1002 World Cultures, an interdisciplinary lecture and recitation course taken in the second semester of the first year; UN 2001 Revisions, an oral and written communications course; and UN 2002 Institutions, an interdisciplinary course on human political and economic organizations.

World Cultures and Institutions serve as prerequisites for the five-course distribution requirement. Students choose courses from five distribution lists that are entitled (1) Language, Thought, and Value; (2) Aesthetics and Creativity; (3) Histories and Cultures; (4) Science, Technology, and Society; and (5) Politics, Economics, and Social Institutions. Students must take two courses each from two of the lists and a fifth course from any list (see General Education section, page 137 for distribution lists). Some programs may specify one particular distribution course. See your program requirements. A number of 2000-level distribution courses will be designated as courses that can be taken during the first year in the same term as Perspectives and/or World Cultures. A maximum of 6 credits of 2000-level courses may be used for the distribution requirement.

Students must have a minimum of 16 credits of science, engineering, and mathematics. At least 12 of those credits must be outside the student's major field. Students must complete one course each (3 credits or more) in mathematics and laboratory sciences. For eligible courses to fulfill this requirement, see your department or advisor or the General Education section, p. 137 for suggestions.

In the co-curricular requirement, three semester units will be physical education activities, most of which are .5 co-curricular units. These units are required for graduation but are not included in the calculation of the GPA or in the overall degree-credit requirement.

For additional information, refer to an academic degree program and/or the General Education section, p. 137.

Grade Reports

www.admin.mtu.edu/em

Mid-Semester Grades—Grades of “satisfactory” or “unsatisfactory” are given to all first-year students at mid-semester. Final letter grades are provided at the end of each semester.

Semester-End Grades—Students may access their semester-end grades through the Office of Records and Registration Web site or they can call Grades-by-Phone (1-800-599-2148 seven-days-a-week, twenty-four-hours per day until the third week of the following semester). Access to the Web site or telephone line requires that the student provide both an ID number and a PIN number. Grades are mailed to the student only upon request. Grades submitted to OSRR will be available over the telephone by 8:00 a.m. the following day.

Disputed Grades—A student having an error in a final course grade should contact the instructor and the registrar as soon as possible but no later than one month after the beginning of the next semester.

Graded student work (exams, papers, homework, etc.) that has not been returned to the student should be retained by the instructor of record for at least 30 days after the beginning of the next semester or until existing disputes have been resolved.

Official Transcripts—Students or alumni may request official transcripts of their academic records from the Office of Student Records and Registration at no charge. Write a brief letter, which includes the exact address where each transcript should be sent and also contains your full name and any former names, Social Security Number (for verification purposes only), graduation date or the year you last attended MTU, address and phone number, and signature.

Fax the letter to 906-487-3343 or mail it to Office of Student Records and Registration, Michigan Technological University, 1400 Townsend Drive, Houghton, MI 49931-1255.

Unofficial Transcripts—Available through the Office of Student Records and Registration Web site <www.admin.mtu.edu/em>.

Grading Policies

Grade Point Average (GPA)—The grade and credit earned for any course taken by a student at MTU will become part of the student's permanent record and will be used in the computation of the University grade point average (GPA). The courses and grades acceptable toward a degree is the prerogative of the degree-granting department.

The GPA is computed by dividing the grade points by the grade point hours. Grade point hours include those course credits with grades of A, AB, B, BC, C, CD, D, F, and X. Any performance below a GPA of 2.00 is considered a grade point deficiency.

Minimum GPA—A requirement for an undergraduate degree is that a student earn a minimum cumulative 2.00 GPA and a minimum 2.00 GPA in the student's major department. Incomplete (I) grades remaining at graduation are considered failing (F) grades in computing the final GPA.
Grading System—The grades awarded by the University are

- A (excellent)—4.00 grade points/credit
- AB (very good)—3.50 grade points/credit
- B (good)—3.00 grade points/credit
- BC (above average)—2.50 grade points/credit
- C (average)—2.00 grade points/credit
- CD (below average)—1.50 grade points/credit
- D (inferior)—1.00 grade points/credit
- F (failure)—0.00 grade points/credit
- I (incomplete)—given only when a student is unable to complete a segment of the course because of circumstances beyond the student’s control. It must be made up by the close of the next 3 semesters in residence or the I grade becomes a failure (F). A grade of I may be given only when approved in writing by the department chair. Incomplete grades at graduation are considered F grades in the final GPA.
- X (condition)—no grade points/credit; given only when the student is at fault in failing to complete a segment of a course, but in the judgment of the instructor does not need to repeat the course. The X grade becomes a failure (F) if it is not made up within the next semester in residence. An X grade is computed into the GPA as an F.
- M (missing grade)—see instructor for clarification.
- N (no grade)—no credit, no grade points; given when a student officially withdraws from the University after the regular drop period, passing the subject. In these cases, the registrar notifies the instructor that the student has withdrawn from the University and should receive an N grade if passing as of the date of withdrawal. The student’s grade form will come to the instructor at the end of the course in the normal manner.
- P (progress)—may be used for approved 3000- or 4000-level project courses, where projects carry over for more than one semester.
- Q (inadequate progress)—may be used for approved 3000- or 4000-level project courses where projects carry over for more than one semester.
- W (late drop)—no credit, no grade points; indicates a course was dropped after the fourth week and by the end of the eighth week; after the eighth week, a student may only request a late drop from the Office of Student Affairs, which will consider only those requests that clearly involve extenuating circumstances beyond the student’s control. Those drops approved by the Office must also have the comments of the student’s departmental advisor and instructor. The grade will appear on the transcript as a W.
- Cr (credit)—by advanced placement or examination.
- S (satisfactory)—credit given, no grade points, and not included in student’s GPA; given for courses taken under the Pass-Fail option. A grade of S is given for work equal to a letter grade of A–C
- E (effort unsatisfactory)—no credit, no grade points; given for courses taken under the Pass-Fail option. A grade of E is given for work equal to a letter grade of CD–F.
- V (satisfactory audit)—no grade points or credit; given for courses taken for audit.
- U (unsatisfactory audit)—no grade points or credit; given for courses taken for audit.

Audit Option—Courses are typically taken for audit by students wishing to refamiliarize themselves with the material. A course taken as an audit may be taken at a later date for credit subject to the approval of the student’s major department. Students auditing courses will be charged the same tuition as credit courses. Students have one week after classes begin to change their registration (audit versus letter grade). After that time, changes in registration must be approved by the registrar. A course failed under the pass-fail option may be repeated only for a letter grade. If a pass grade is received, the course may not be repeated.

Pass–Fail Option—The purpose of the pass-fail option is to encourage the student to explore areas of study outside the major field without the pressure of competition for a letter grade. Students have one week after classes begin to change their registration (pass-fail versus letter grade). After that time, change in registration must be approved by the registrar. A course failed under the pass-fail option may be repeated but only for a letter grade. If a pass grade is received, the course may not be repeated.

When a course is offered only on a pass-fail basis, the following provisions and restrictions on the pass-fail option do not apply:

- This option is only available to students after one semester of residence in the University. Juniors and seniors must have a GPA of 2.50 or higher; freshmen and sophomores must have a GPA of 3.00 or higher. Students will be allowed to take a maximum of one course per semester on a pass-fail basis, up to a total of six courses.
- No course taken for a letter grade may be repeated under the pass-fail option. Courses must be elected with the approval of the advisor.
- The courses available under this option are elective courses not specifically named by the student’s major department as required for a degree or otherwise excluded by the department. No university-wide credit requirement can be met with an S grade.

Graduation Requirements

Each student is expected to successfully complete the required courses prescribed for their curriculum. Substitutions must be approved by the department advisor and department chair and submitted for file with Degree Services. All degree candidates may participate* in a commencement ceremony provided they meet the following criteria:

1. A cumulative university GPA of at least 2.00
2. A major department GPA of at least 2.00
3. An Application for Graduation for each degree/certificate program.
   - The Application for Graduation must be submitted to the Degree Services Office one term prior to the scheduled commencement ceremony.
4. A degree audit, approved by the major department, for each degree/certificate program.

In order to insure eligibility, the degree audit must be on file in the Degree Services Office one term prior to completion of all degree requirements. Incomplete (I) grades remaining at graduation are considered failing (F) grades in computing the final GPA.

* Participation in a commencement ceremony is NOT equivalent to graduation. Since the ceremony occurs several days before final grades are submitted, it is not possible at that time to determine if all degree requirements are met. Graduation becomes official after all grades are received and the degree notation is placed on your academic record.

Records—Privacy and Access

Record Requests—Requests for review of a record other than grades are made in writing to the Office of Student Records and Registration, which can make arrangements for the student to review the record in the presence of an appropriate University staff member.

Public Student Information—Michigan Technological University, Houghton, Michigan, hereby by public notice, and in order to comply with Section 438 of Public Law 93-380 designates the following student information as public or "directory information": student name, mailing address, telephone number, home town, e-mail address, major field of study, participation in officially recognized activities and sports, weight and height of athletic team members, attendance dates, degrees and awards received, and most recent previous school attended.

Withholding Disclosure—Currently enrolled students may withhold disclosure of the above information, except name, under the Family Education Rights and Privacy Act of 1974, by submitting written notification to the Office of Student Records and Registration within two weeks of the start of classes for any semester. Such notification will prevent disclosure to non-University personnel.
University Information & Freedom of Information Act
Michigan Tech is committed to maintaining a free exchange of information throughout the University community, and it is our general practice to release most types of information immediately upon request. In addition, as a publicly funded institution, Michigan Tech is subject to the provisions of the state and federal Freedom of Information Acts (FOIA). FOIA requires the University to provide copies of most administrative documents, with the exception of certain legal and personnel records, to anyone filing a FOIA request. If you wish to file a Freedom of Information Act request or if you would like to view University documents, contact the Office of the President 487-2200.

Registration
All students are required to register each semester during the dates specified in the University Academic Calendar, which includes class selection, data verification, acquiring the combined billing statement, and making the applicable payment by the due date. Registration is confirmed when the required payments have been made.

While every effort is made to ensure that the Time Schedule Booklet is accurate at the time of printing, unforeseen circumstances or low enrollments may cause the cancellation of some section(s) or course(s). Michigan Tech also reserves the right to change the days, times, rooms, or instructors of section(s) or course(s) as deemed necessary.

Late Registration—Late registration must be completed no later than five days after the beginning of regular instruction. A student may not enroll for the semester after the five-day late registration period has passed.

Prerequisites—A student may not elect a course without the proper prerequisites. Course prerequisites in which D grades were earned should be repeated before electing the advanced course.

Financial Obligations—Having fulfilled all other requirements, a student is eligible for registration or graduation only if all financial obligations to the University have been met. The OASR, on notice from the Accounting office, will withhold transcripts, grades, and deny registration to a student with an amount owed the University. Scheduled classes will be dropped if the amount due is not cleared by the due date. Also, students with an outstanding balance will not be permitted to schedule classes.

Schedule Changes—Within one week of the beginning of the semester and subject to the allowable maximum, students may make the following changes in their schedules: adding or dropping classes, changing credits on variable-credit courses, section changes, and option changes (pass-fail vs letter-grade and audit vs letter-grade option changes).

Dropping Classes—If a student drops a course during the first three weeks of a semester, the course is not entered on the student's transcript. First-year students may drop a course only after first discussing their status with the instructor and then securing approval of the appropriate academic advisor. Students must be aware how dropping a course affects their progress toward graduation.

Schedule Changes—Within week one of the beginning of the semester and subject to the allowable maximum, students may make the following changes in their schedules: adding or dropping classes, changing credits on variable-credit courses, section changes, and option changes (pass-fail vs letter-grade and audit vs letter-grade option changes).

Dropping Classes—If a student drops a course during the first three weeks of a semester, the course is not entered on the student’s transcript. First-year students may drop a course only after first discussing their status with the instructor and then securing approval of the appropriate academic advisor. Students must be aware how dropping a course affects their progress toward graduation.

From the beginning of the fourth week through the end of the eighth week of a semester, courses dropped will be indicated by a grade of W on a student's transcript.

After the eighth week of a semester, a student may request a late drop from the Dean of Students office, which will consider only those requests that clearly involve extenuating circumstances beyond a student’s control. Those late drops approved by the office must also have the comments of the student’s departmental advisor and instructor. The registrar will show the course on the student’s transcript with a grade of W.

NOTE: A student who drops all of their classes will be withdrawn from school as of the date those classes were dropped. Students who withdraw from the University must

1. obtain a withdrawal card from the Office of Student Records and Registration and obtain the required signatures as indicated on the withdrawal card;
2. surrender student identification cards to the Tech Express Office.

Withdrawal from the University
Withdrawal Procedure—If you terminate your course work during the semester, it is important that your registration be formally withdrawn. Your failure to submit the Student Withdrawal Card may result in F grades and in payment of tuition and fees which otherwise might be avoided. Withdrawals are processed according to the established refund schedule. Letting the Office of Student Records & Registration know of your plans before the fact helps ensure a smooth withdrawal-readmission process. You may do this over the telephone, through the mail or fax, however we prefer to talk to you in person. If you are not planning to return, a formal withdrawal also assures you of receiving any refunds due you in a timely manner.

NOTE: A student who drops all of their classes will be withdrawn from school as of the date those classes were dropped. Students who withdraw from the University must

1. obtain a withdrawal card from the Office of Student Records and Registration and obtain the required signatures as indicated on the withdrawal card;
2. surrender student identification cards to the Tech Express Office.

Withdrawal of Students Called to Active Military Service
Students called to active duty are guaranteed readmission upon completion of active service. Enrolled MTU students who are called to active military duty will be given the opportunity to work out the best possible solution for maintaining their academic security. They must choose one of the following options before departing for active service:

• Leave for active service with a tuition refund of 100 percent. Refunds involving financial aid will be adjudicated to decrease the payback required from the student to the lowest possible amount.

• You agree that temporary grades will be issued for enrolled courses. The temporary grades will be P for Progress or I for Incomplete. In some cases, arrangements can be made to complete the course work while on active duty. Otherwise, the student may complete the courses when he/she returns to the University.
Student Life

Activities
www.mtu.edu/level3/1-3cal.html

MTU offers opportunities for students to participate in a multitude of activities. WebCal, an electronic calendar off MTU’s home page, lists all University events, including student events.

Student Organizations
www.sos.mtu.edu

More than 165 student groups are registered on campus, including governmental, cultural/ethnic, Greek, social, special interest, media, honorary, religious, service, leadership, professional, and club sports groups. Many of these groups become involved in new student orientation, Homecoming, Winter Carnival, and other events.

Undergraduate Student Government (USG)—USG is the voice of the student body. It oversees the disbursement of the revenue collected through the activity fee as well as works with student groups to help resolve issues. USG offices are located in the Memorial Union Building.

Tech Traditions

K-Day—Classes are cancelled at noon on Friday of the second week of fall semester so that Tech can celebrate Keweenaw Day. Everyone heads out to McClain State Park for a day of food, fun, and music.

Parade of Nations—The Parade of Nations and Multicultural Festival in September celebrates diversity with a day-long event of ethnic food, culture, music, and dance.

Homecoming—Besides the usual homecoming queen and football game, there is a parade featuring unique cars, thanks to some customizing. Other Homecoming activities include bed races, human pyramid, and tug-of-war challenges; a tailgate party before the big game; and professional entertainment.

Winter Carnival—Winter Carnival started in 1922 and has grown to become one of the largest annual winter festivals in the nation, featuring huge snow statues on campus and in the local area; a home hockey series; men’s and women’s varsity basketball; skits, broomball, and other sports; sleigh rides; a Winter Carnival queen; and basic midwinter fun. Winter Carnival is usually held in late January or early February with students getting two days off from classes.

Spring Fling—On a Friday afternoon in early May, students end the academic year and welcome warmer weather by engaging in activities such as pie-throwing at professors, mud volleyball (oozeball), karaoke, and listening to rock bands at the Spring Fling festival. More than fifty student groups participate in this event with food and entertainment for a huge snow statues on campus and in the local area; a home hockey series; men’s and women’s varsity basketball; skits, broomball, and other sports; sleigh rides; a Winter Carnival queen; and basic midwinter fun. Winter Carnival is usually held in late January or early February with students getting two days off from classes.

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Fine Arts
www.fine.arts.mtu.edu

The Department of Fine Arts presents cultural events and activities for the campus and community. Programs offered include the following:

Music—Provides students, faculty, and community residents with opportunities to participate in musical ensembles, including Concert Choir, Echoes from Heaven Gospel Choir, MTU Wind Symphony, Huskies Pep Band, Jazz Lab Band, R&D Big Band, Jazztec, the Keweenaw Symphony Orchestra, and other jazz and chamber groups.

University Theatre—Offers a varied season each year, ranging from comedies and classics to musicals and experimental productions. The fine arts department also sponsors The Troupe, an improvisational ensemble.

Visual Arts—Presents courses in watercolor, oil painting, sketching and drawing, three-dimensional design and sculpture, and graphic design. In addition, the visual arts program sponsors residencies and workshops by professional artists and offers opportunities for students to exhibit their work.

Cultural Enrichment

The University sponsors a broad variety of cultural activities, including art exhibits, dance and theater touring companies, musical ensembles, performing artists, and lectures by topical (and often controversial) speakers. The variety of offerings provides opportunities for students to broaden their cultural education and enjoy professional entertainment. Students are also involved in the programming, promotion, and production of cultural events.

Athletics

Intercollegiate Athletics (NCAA)
www.athletics.mtu.edu

Michigan Tech has a thirteen-sport intercollegiate athletic program, highlighted by its Division I men’s ice hockey team, a program that has captured three national championships. Other men’s programs include football, basketball, cross country, track and field, tennis, and nordic skiing. A strong women’s program, one which has witnessed nine NCAA tournament appearances in basketball and five in volleyball in the 1990s, also includes programs in cross country, tennis, nordic skiing, and track and field.

Intramurals
www.mtu.edu/sports/imsport.html

The Department of Physical Education, through its Intramural/Recreational Sports Services Office, offers competition in more than thirty different intramural events—from badminton to water polo—for Michigan Tech’s students, faculty, and staff. Stop by the Intramural Office, room 202, Student Development Complex for IM handouts and information.

Recreational Facilities

The University owns and operates multiple athletic facilities and recreation areas for the benefit of its students, faculty, and staff. Facilities include the Student Development Complex, the Gates Tennis Center, and numerous other indoor and outdoor facilities, both on and off campus, for team sports, skiing, golf, tennis, and bowling.

Student Development Complex (SDC)—A 235,000 square-foot, indoor sports arena located on the Michigan Tech campus. Students may use the facilities free of charge. The SDC features the following:

• weight room with Hammer equipment
• racquetball and squash courts
• basketball and volleyball courts
• running track
• swimming pool (8-lane, 25-yard)
• diving pool
• gymnasium
• dance room
• gymnastics room
• rifle range
• ice arena
• locker rooms with showers and saunas
• sports equipment rentals
• University Images (MTU apparel)

Gates Tennis Center—Also located near the SDC, features
• tennis courts, indoor (4 with a minimal fee)
• ball machine
• locker rooms with showers
• pro shop for racquet stringing and repairs

Other facilities (on and off campus)
• bowling alley (6 lane) in the Memorial Union Building
• golf course (18-hole), Portage Lake Golf Course south of Houghton
• downhill ski area at Mont Ripley in Hancock
• cross-country ski trails (7.4k) near the SDC
• tennis courts, outdoors
• play/practice areas
• softball fields
• football/track stadium

Health Care
www.phsys.org

The Houghton Community Health Center (483-1860) provides primary medical care for Michigan Tech students, their spouses, and their dependents on a fee-for-service basis.

The Clinic is located adjacent to the SDC on Machinnes Drive (open 8am–5pm, Monday–Friday, 9am–1pm Saturday). Qty bus service is available. An itemized statement is provided for the student to submit to the health insurance company for reimbursement. After-hours and hospital emergency care is provided by Portage Hospital in Hancock, (483-1000) a member of Portage Health System.

Student Health Insurance—All University students are eligible to enroll in a group health insurance plan sponsored by the Undergraduate Student Government. This optional plan covers various types of medical care and hospitalization, including many health service charges.

International students may enroll in this plan to provide the required proof of medical health insurance before registration.

Housing
www.housing.mtu.edu

Housing Policy—All single students are required to live in university housing during their first year of attendance at MTU. This policy does not include transfer students, graduate students, or commuting students living at home with their parents. Students should clarify their status with the Residential Services Office prior to making an off-campus housing commitment.

Housing Contract—Residential Services sends a contract for accommodations in the residence hall when the applicant is accepted for admission. Priority for honoring hall and roommate preferences is based on the date the completed contract is received.

Residence Halls
Facilities—Douglass Houghton Hall, McNair Hall, and Wadsworth Hall offer accommodations for 2,200 students. Each residence hall has comfortable rooms, large lounges, a dining room, laundry facilities, and recreation areas. Wadsworth Hall also has a few suite-type rooms (two separate two-person rooms sharing an adjoining lavatory).

Lifestyle Options—Other living options include the International House, the Chemical-Free Lifestyle, the Smoke-Free Lifestyle, the First-Year Experience House, and Healthy Living/Fitness House. Applications are available on the Web at <www.housing.mtu.edu/reslife/options_frame.htm>

The I-House (International House), located in McNair Hall, is a co-educational multicultural residential living and learning center designed to promote understanding among its residents from different nations and cultures of the world. Two resident assistants and one program assistant plan and encourage residents to participate in the many educational and social activities on international and multicultural topics. This area includes a kitchenette. A 12-month housing contract is also an option for students. Choose the I-House on your housing profile for a brochure and an application.

Chem-Free Housing is offered in all three of our residence halls. Currently thirty-three houses have this lifestyle option where residents have chosen to live a chemical free life. The use and/or possession of tobacco, alcohol, or illegal substances is not permitted by the residents or their guests.

Smoke Free Housing is offered in all three of our residence halls. Currently twenty-three houses have this lifestyle option where residents have chosen to prohibit smoking by themselves and by their guests.

First Year Experience, located in East Wadsworth Hall, is a living option offered to first-year students to build a solid foundation for their success in college. Three upper-class students live on the floor and serve as resident assistants and peer advisors; several students who have participated in the program serve as mentors and also live in the FYE house. If you choose this option, you will participate in educational and social activities, as well as enroll in the University course, Foundations for Success. A faculty member holds office hours in the area to give students academic assistance. This area includes a Community Room and is chemical free living. Choose the FYE option on your housing profile to receive a brochure and an application.

Healthy Living/Fitness House, located in East Wadsworth Hall, will be available in fall 2001. Designed to promote healthy living and fitness, activities and programming will include exercise groups, fitness plans, eating right, sleeping, stress reduction, increased quiet hours, substance free lifestyle, and outdoor trips. The house will be co-ed and open to all returning and new residents.

The Community Governed Area is a living option offered in East McNair Hall to students who are 21 or over or entering their 3rd year of college. Students can assist in determining some policy guidelines, like quiet hours, through the development of a Community Living Agreement. An option for 5-meal plan and a monthly room and board payment plan is also available. Kitchen and laundry facilities are located in the area.

Dining Services—All residents must choose a meal plan. First-year students may choose between the 19- and 14-meal plans. The 19-meal plan includes all meals offered and $90 dining dollars per year. The 14-meal plan includes up to 14 meals per week and $160 dining dollars per year. Dining dollars allow students to eat at other more convenient times or places than at their own residence hall.

Residence Life Staff—Residence hall professional staff live in each hall and maintain regular office hours. They provide information and aid in dealing with academic, personal, and emotional problems. Residents are encouraged to seek their assistance with questions or problems.

MTU Apartments
www.housing.mtu.edu

The University maintains 350 one- and two-bedroom apartments on campus in an area called Daniell Heights. The apartments overlook campus and are convenient to both the campus and the Student Development Complex. Rates depend upon type of contract and occupancy. All utilities, except for telephone and cable, are provided. Each apartment is semi-furnished, including an electric range and refrigerator. Each building of six to eight apartments shares a free washer and dryer. Picnic tables and children’s play areas are located throughout the Heights.

A preschool nursery (located in the Community Building) gives a discount to any Heights resident. Other amenities include a basketball court, high-speed computer access option, bike storage lockers, and free bus service from the apartments to and from main campus. Go to the Web site or write to MTU Apartments Office, Michigan Technological University, 2001B Woodmar Drive, Houghton, MI 49931-1017.

Off-Campus Housing
www.admin.mtu.edu/dos/housing/housing.html

Many students choose to continue to live in residence halls beyond their first year, while others elect to live off campus in apartments, homes, or with greek organizations. In order to assist those students interested in locating off-campus housing, USG maintains a list of off-campus householders renting to students, which is available from the USG Office, room 106, Memorial Union Building.
Support Services

Career Center
www.ucc.mtu.edu

The University Career Center is designed to meet the career planning and placement needs of all MTU students. Services include seminars, corporate speakers, Career Days, interest testing, a career resource center, individual counseling, orientation sessions, on-campus interviewing, and the SIGI-PLUS computerized career guidance program.

Students are encouraged to visit the Career Center early in their academic career. By participating in summer or co-op work experiences, learning how to interview, and being introduced to the corporate world, students will be better prepared to look for permanent employment.

Students are also encouraged to attend the many job fairs sponsored by MTU both on and off campus. As on-campus interviewing declines across the nation, job fairs represent a very important way for students to seek summer, co-op, and permanent employment opportunities.

Child Care
MTU and the Baraga-Houghton-Keweenaw Child Development Board have joined efforts to create a high-quality child-care facility for Michigan Tech students, faculty, and staff. The Michigan Tech Child Care Center will accept children from 4 weeks to 4 years of age. Located near campus, the hours are from 7:30 AM–5:30 PM, Monday–Friday. For more information, call 906-482-3663 or 800-236-5657.

Counseling Services
www.counseling.mtu.edu

Counseling Services assists students with those social and personal/emotional issues that may interfere with the effective use of their talents at MTU. Professional counselors are available in the Counseling Center, which is located on the main campus in the white house next to Fisher Hall. Confidential services are available for both individuals and groups.

Counseling helps students improve their feelings of well-being by assisting in the development of decision-making skills, stress management skills, interpersonal communication skills, and self-awareness. Any concern a student may have, including depression, pregnancy, anxiety, loneliness, substance abuse, or relationship problems, can be discussed.

The Myers-Briggs Type Indicator is administered and interpreted. Workshops are offered in the areas of time management, study skills, eating disorders, substance abuse, and self-defeating behaviors.

Center for International Education
www.mtu.edu/cie

The Center for International Education offers all undergraduate students regardless of their discipline affordable and academically relevant opportunities for study abroad. In addition, the CIE organizes and supports a number of international programming activities on campus and in the community. These include the International Club, the Parade of Nations, the Ambassadors Speakers Program, and more. The CIE is also the home-away-from-home for more than 500 international students studying at Tech.

Educational Opportunity (EO)
www.yth.mtu.edu

Educational Opportunity (EO), working with other Michigan Tech departments, provides academic, professional, and personal educational opportunities for students through partnerships with industry, community colleges and secondary schools. EO Youth Programs and outreach divisions support the recruitment and retention of a diverse student body. The department programs focus on topics that address the needs of precollege, female, minority, and nontraditional students. EO also coordinates campus and community multicultural activities, conferences and institutes, Summer Session, and other continuing education programs.

The department hires and trains a large number of undergraduate and graduate students to work on a variety of academic, diversity, and youth programs throughout the year.

Information Technology (IT)
www.tc.mtu.edu/cs

IT provides the foundation for Michigan Tech’s computing environment and manages the network, data, telephone, video, applications, and systems infrastructure needed to support University’s education, research, and community service missions. Specific academic computing resources are offered by the individual schools and college departments. Campus and global network access from the residence halls (Resnet) are available through IT Customer Service. Other offerings include pager leasing, discounted off-campus ISP service, cable TV and movie channels, long distance service, and computer sales and service, including Apple Computer products.

Library
www.lib.mtu.edu

The J. Robert Van Pelt Library contains more than 800,000 volumes and regularly receives approximately 10,000 serials and periodicals. The library also acquires foreign and official documents. It is a designated depository for official foreign, US government, and Michigan state documents, and for the US Army Map Service. The library archives maintains an important collection of original materials concerning the history of the Keweenaw region, including the records of various copper mining companies.

Mineral Museum
www.geo.mtu.edu/museum

MTU is home to one of the nation’s premier collections of crystals, minerals, and ores. The Seaman Mineral Museum, the official “Mineralogical Museum of Michigan,” contains more than 65,000 specimens, including the world’s finest display from Michigan’s copper and iron mining districts.

Student Affairs Office
www.admin.mtu.edu/dos

The dean of Student Affairs Office provides support to students in co-curricular and extra-curricular areas, including academic counseling. It provides services, programs, opportunities, and activities that enrich and support the academic experience of students. Its goal is to create the best possible environment for the professional and personal growth and development of students. Bring issues, problems, or ideas to the attention of student affairs staff.
General Education

General Education Goals
www.admin.mtu.edu/admin/upinst/gened.htm

Our general education goals include developing in each student:

• fundamental scholastic habits of careful reading, critical reasoning, balanced analysis and argument;
• the habit of applying multiple disciplinary perspectives in interpretation, analysis, and creative problem solving;
• respect for diversity and awareness of complex contexts of their study and their work;
• and knowledge of a broad range of topics and disciplines complementary to the major.

The General Education curriculum is made up of the following requirements:

1. Core Option for UN 1002
   Two semesters of a modern language along with UN 1003 World Cultures Activities may substitute for UN 1002 for a total of 7 credits.

2. Distribution Course Option
   International study option for distribution courses—Students may meet distribution course requirements with courses taken in MTU-approved university programs outside the United States. The following conditions apply:
   a. Credit applied toward meeting distribution course requirements will be proportional to the level of contact hours and commitment to outside work required at the overseas program. To receive credit for a 3-credit distribution course, the number of contact hours and the requirement for the student’s work outside of class should be essentially the same as 3 credits of study at the 3000 and 4000 level at MTU.
   b. Course work successfully completed in an international study program can be applied only once to meet graduation requirements. If the course is applied to meet a requirement in the major, the same course cannot also be used to meet a General Education requirement.
   c. Courses to be applied to meeting General Education distribution requirements must be approved by the Center for International Education prior to the student enrolling in those courses.

3. Distribution Courses (15 credits)
   UN 1002 World Cultures and UN 2002 Institutions serve as prerequisites for the 15-credit distribution requirement. The distribution courses are divided among five lists, entitled:
   a. Language, Thought, and Values (World Cultures)
   b. Aesthetics and Creativity (World Cultures)
   c. Histories and Cultures (World Cultures)
   d. Science, Technology, and Society (Institutions)
   e. Economic, Political, and Social Institutions (Institutions)

Students must take two courses each from two different lists, one that has World Cultures as a prerequisite and one that has Institutions as a prerequisite. The fifth course may come from any list. A number of 2000-level distribution courses, marked with an asterisk on pp 138–39, are designated as courses that can be taken during the first year in the same term as Perspectives and/or World Cultures.

UN 1001 Perspectives on Inquiry is an interdisciplinary seminar taken in the first semester of the first year.
UN 1002 World Cultures is an interdisciplinary lecture/recitation course taken in the second semester of the first year.
Revisions is an oral and written communications course.
Institutions is an interdisciplinary course on human political and economic organizations.

4. For curricula that DO NOT SPECIFY mathematics and lab science requirements, students can meet these requirements by taking:
   a. any MAT or MA course of 3 credits or more at the 1000 level or above
   b. any BL (biology), CH (chemistry), FW (forestry), GE (geology), or PH (physics) course that is 3 credits or more and includes a lab component as a separate course.

Note the following restrictions:

1. At least 12 of those credits must be outside the student’s major field.
2. Students must complete one course in mathematics and one laboratory science course. Requiring computer science is at the discretion of the department.
3. The distribution of the required 16 credits varies by curriculum. Some programs specify 16 credits; others may not. For example, a computer science course may be a requirement for some departments but not others.
4. For curricula that DO NOT SPECIFY mathematics and lab science requirements, students can meet these requirements by taking:
   a. any MAT or MA course of 3 credits or more at the 1000 level or above
   b. any BL (biology), CH (chemistry), FW (forestry), GE (geology), or PH (physics) course that is 3 credits or more and includes a lab component as a separate course. A student must successfully complete both the lab and recitation portions of these courses in order to meet the requirement.

Co-Curricular Activities (3 units)

Three co-curricular units are required for graduation. A unit involves the same time commitment as an academic semester credit but is not included in calculation of the GPA, nor in the overall degree-credit requirement.

As a part of the co-curriculum, titles of activities successfully completed will appear on the student’s transcript with a pass/fail grade. These hours will be included as “earned hours” but will not be included in the GPA hours.

Enrollment in a co-curricular activity will count toward satisfactory progress for financial aid purposes and toward status as a full-time student. Some co-curricular activities may have lab fees.

Please note that in semesters, most physical education activities will last for 7.5 weeks or a half semester. A student would need six of these .5 semester units to fulfill the 3 semester unit co-curricular requirement.
Distribution Course Lists

- Take two courses each from two different lists, one that has World Cultures as a prerequisite and one that has Institutions as a prerequisite. The fifth course may come from any list.
- Only 3 credits designated as “activities” may count in the distribution list selections.
- A maximum of 6 credits of 2000-level courses may be used to meet the distribution requirement. Incoming transfer students’ credits are evaluated individually for distribution credit.
- Courses, marked with an asterisk below, are designated as courses that can be taken during the first year in the same term as Perspectives and/or World Cultures.

1. Language, Thought, and Values (UN 1002 prerequisite)
   ED 3110 Psychological Foundations of Learning
   ENG 2962 Communication Contexts
   ENG 3962 Communication Strategies
   ENG 4952 Complex Communication Practices
   ENG 4953 Writing about Engineering in a Societal Context
   FA 2090* Speech Communication
   HU 2130* Introduction to Rhetoric
   HU 2212 Level II-B French Lang. & Cult.
   HU 2215 Level II French Comp. & Conv.
   HU 2221 Level II-A German Lang. & Cult.
   HU 2222 Level II-B German Lang. & Lit.
   HU 2225 Level II German Comp. & Conv.
   HU 2231 Level II-A Spanish Lang. & Cult.
   HU 2232 Level II-B Spanish Lang. & Lit.
   HU 2235 Level II Spanish Comp. & Conv.
   HU 2505* Science, Technology & Hum. I
   HU 2506* Science, Technology & Hum. II
   HU 2520* Cultural Diversity in American
   HU 2548* Adolescent Literature
   HU 2700* Intro. to Philosophy
   HU 2701* Logic and Critical Thinking
   HU 2820* Communication and Culture
   HU 2830* Intro. to Speech Communication
   HU 2910* Language and Mind
   HU 2920* Language & Society
   HU 3120 Technical & Scientific Comm.
   HU 3130 Rhetorical Theory and Criticism
   HU 3150 Reading and Writing
   HU 3151 Rhetoric of Everyday Texts
   HU 3212 French for Special Purposes
   HU 3222 German for Special Purposes
   HU 3232 Spanish for Special Purposes
   HU 3540 Major British Authors
   HU 3541 Major American Authors
   HU 3554 Contemporary British Authors
   HU 3605 Grammar and Usage in Society
   HU 3621 Introduction to Journalism
   HU 3710 Engineering Ethics
   HU 3711 Biomedical Ethics
   HU 3820 Interpersonal Communication
   HU 3840 Organizational Communication
   HU 3910 Language in the World
   HU 3930 Language and Education
   HU 4542 Topics in American Literature
   HU 4545 Topics in World Literature
   HU 4700 Topics in Philosophy
   HU 4701 Political Philosophy
   HU 4702 Environmental Philosophy
   HU 4703 Issues in Communication Ethics
   HU 4820 Modes of Communication
   HU 4830 Philosophy of Communication
   HU 4890 Topics in Communication
   PE 4010 Psychology of Coaching
   PSY 2000* Principles of Psychology
   PSY 3030 Abnormal Psychology
   PSY 3050 Developmental Psychology
   PSY 4010 Cognitive Psychology
   2. Aesthetics and Creativity (UN 1002 prerequisite)
   FA 2150 Drawing II (activities)
   FA 2200* Watermedia I (activities)
   FA 2250* Oil Painting I (activities)
   FA 2300* Two-Dimensional Design
   FA 2330* Art Appreciation
   FA 2420* Jazz Lab Band (activities)
   FA 2500* Music Theory I
   FA 2502* Music Appreciation
   FA 2600* The Technique of Acting (activities)
   FA 2660* Mainstage Theatre: Acting (activities)
   FA 2820* Theatre Appreciation
   FA 3090* Performance Comm. (activities)
   FA 3150 Life Drawing (activities)
   FA 3200 Watermedia II (activities)
   FA 3250 Oil Painting II (activities)
   FA 3300 Three-dimensional Design
   FA 3333* Sculpture I (activities)
   FA 3340 Art History II
   FA 3400* Kew. Symphony Orch. (activities)
   FA 3401* Wind Symphony (activities)
   FA 3420* R & D Jazz Band (activities)
   FA 3500* Gospel Choir (activities)
   FA 3510* Concert Choir (activities)
   FA 3530 Music Theory II
   FA 3540 African-American Film
   FA 3670* Acting Ensemble (activities)
   FA 3700 Scenic Design (activities)
   FA 3750 Lighting Design (activities)
   FA 3780 Advanced Theatre Interpretation
   FA 3800 Dramatic Literature
   FA 3840 Myth and World Theatre
   FA 4200* Adv. Watermedia Studio (activities)
   FA 4300 Sculpture Studio (activities)
   FA 4400* Chamber Music Seminar (activities)
   FA 4420* Musical Perf. Arts: Jazz (activities)
   FA 4460* Creative Writing
   FA 2224* Introduction to Film
   FA 2517* Anglo-Amer. Literary Studies
   FA 2547* World Drama
   FA 2631* Fund. of Photography (activities)
   FA 2645 Graphic and Information Design
   FA 3120 Technical & Scientific Comm.
   FA 3324 Visual Media Analysis
   FA 3510 The American Novel
   FA 3512 Shakespeare I
   FA 3513 Shakespeare II
   FA 3629 Practical Writing
   FA 3634 Television Production I (activities)
   FA 4110 Advanced Creative Writing
   FA 4642 Special Topics in Advanced Media

3. Histories and Cultures (UN 1002 prerequisite)
   AF 2001 USAF Air and Space Power I
   AF 2002 USAF Air and Space Power II
   BA 4780 International Business Comm.
   EC 3020 History of Economic Thought
   FA 3300 Art History I
   FA 3550 History of Jazz
   FA 3560 Music History
   FA 3810 Ancient Theatre History
   FA 3820 American Theatre History
   FA 3830 American Musical Theatre
   HU 2501* The American Experience in Lit. I
   HU 2502* The American Experience in Lit. II
   HU 2538* British Experience in Literature I
   HU 2539* British Experience in Literature II
   HU 3120 Technical & Scientific Comm.
   HU 3211 Topics in French Literature
   HU 3221 Topics in German Literature
   HU 3231 Topics in Spanish Literature
   HU 3251 Modern Masters
   HU 3252 Literature in Translation
HU 3253 Essays of World Cultures
HU 3261 Intercultural Communication
HU 3262 Topics in Francophone Cultures
HU 3263 Topics in German-Speaking Cult.
HU 3264 Topics in Spanish-Speaking Cult.
HU 3501 Medieval Literature
HU 3502 World Mythologies
HU 3504 Novels from World Literature
HU 3551 Renaissance Literature
HU 3552 Restoration & 18th Century Lit.
HU 3553 Nineteenth-Century British Lit.
HU 3555 Twentieth-Century British Authors
HU 3556 Cultural Studies
HU 3560 Pop Culture
HU 4212 Mod. Lang. Seminar II-French
HU 4213 Mod. Lang. Seminar-French III
HU 4222 Mod. Lang. Seminar II-German
HU 4223 Mod. Lang. Seminar-German III
HU 4232 Mod. Lang. Seminar II-Spanish
HU 4233 Mod. Lang. Seminar-Spanish III
HU 4840 International Communication
PSY 3070 Cross-Cultural Psychology
SS 2800* Science, Technology, & Society
SS 2900 Environmental Problems
SS 3100 World Resources & Development
SS 3200 History of American Technology
SS 3300 History of Science in America
SS 3310 The Automobile in America
SS 3320 Technology & Western Qv.
SS 3330 Energy Technology and Policy
SS 3340 Culture, Science, & Technology
SS 3350 Environmental Issues

5. Economic, Political, and Social Institutions (UN 2002 prerequisite)
AF 3001 USAF Leadership Studies I
AF 4001 National Security Affairs I
BA 4760 Strategic Leadership
EC 2000 Principles of Economics
EC 3000 Microeconomic Theory
EC 3010 Macroeconomic Theory
EC 3030 Game Theory/Strategic Behavior
EC 3100 International Economics
EC 3300 Industrial Organization
EC 3400 Economic Decision Analysis**
EC/ENG/3401 Economic Decision Analysis I**
EC/ENG/3402 Economic Decision Analysis II**
EC/ENG/3403 Economic Decision Analysis III
EC 3500 Public Economics
EC 3700 Labor/Human Resource Economics
EC 4400 Banking & Financial Institutions
EC 4600 Nat'l. Resource/Env. Economics
EC 4700 Economics of Health Care
EC 4800 Econ. of Technological Change
ENG 2961 Teamint: Engineering Enterprise
ENG 3961 Engineering Enterprise Strategic Leadership
ENG 4954 Global Competition
FW 3110 Natural Resource Policy
SS 2600* American Government & Politics
SS 2700* Introduction to Sociology
SS 3520 U.S. Environmental History
SS 3600 American Foreign Policy
SS 3610 International Law
SS 3620 International Technology Policy
SS 3630 Environmental Policy & Politics
SS 3700 Industry and Society
SS 3710 Social Problems
SS 3720 Social Psychology
SS 3740 Sociology of Family
SS 3750 Social Inequality
FW/SS 3760 Human Dimensions of Nat. Res.
SS 3890 Industry & the World Economy
SS 3940 World Affairs
SS 3990 Topics in the Social Sciences
SS 4100 American Indian Political Issues
SS 4900 Seminar in Social Sciences

* Course can be taken during the first year in the same term as Perspectives and/or World Cultures.
** For programs that require Economic Decision Analysis, students should take EC 3400 (3 credits), except for civil engineering and mechanical engineering majors who should take EC 3401 (1 credit) and EC 3402 (1 credit).
### Course Descriptions

#### Abbreviations for Departments and Courses

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See the most recent *Time Schedule Booklet* for current offerings of courses. While every effort is made to ensure that the Undergraduate Catalog and *Time Schedule Booklet* are accurate at the time of printing, unforeseen circumstances or low enrollments may cause the cancellation of some section(s) or course(s).

**For more information, contact**

Admissions  
Michigan Technological University  
1400 Townsend Drive  
Houghton, Michigan 49931-1295  
906/487-2335
Air Force ROTC (AF)

**AF 1001 Foundations of US Air Force I**  Introduces students to the USAF and ROTC. Topics include Air Force mission and organization, officership, professionalism, military customs and courtesies, officer opportunities, and communication skills. Leadership Laboratory is mandatory for AFROTC cadets and complements this course by providing cadets with fellowship experiences. Credits: 1.0  Lec-Rec-Lab: (0-1-1)  Semesters Offered: Fall

**AF 1002 Foundations of US Air Force II**  Introduces students to the USAF and ROTC. Topics include Air Force mission, organizations, officer leadership, types of unit, courtesies, officer opportunities, and communication skills. Leadership Laboratory is mandatory for AFROTC cadets and complements this course by providing cadets with fellowship experiences. Credits: 1.0  Lec-Rec-Lab: (0-1-1)  Semesters Offered: Fall

**AF 2001 USAF and Space Power I**  Designed to examine general aspects of air and space power through a historic perspective. Covers from first balloons and dirigibles to the space-age global positioning systems of the Persian Gulf War. Credits: 1.0  Lec-Rec-Lab: (0-1-1)  Semesters Offered: Fall

**AF 2002 USAF and Space Power II**  Examines general aspects of air and space power through a historic perspective. Covers from first balloons and dirigibles to the space-age global positioning systems of the Persian Gulf War. Credits: 1.0  Lec-Rec-Lab: (0-1-1)  Semesters Offered: Spring

**AF 3001 USAF Leadership Studies I**  Study of leadership, management fundamentals, professional knowledge, Air Force personnel and evaluation systems, leadership ethics, and communication skills. Credits: 3.0  Lec-Rec-Lab: (0-3-2)  Semesters Offered: Fall

**AF 3002 USAF Leadership Studies II**  Study of leadership, management fundamentals, professional knowledge, Air Force personnel and evaluation systems, leadership ethics, and communication skills. Credits: 3.0  Lec-Rec-Lab: (0-3-2)  Semesters Offered: Spring

**AR 1001 National Security Affairs I**  Examines national security process, regional studies, advanced leadership ethics, and Air Force doctrine. Credits: 3.0  Lec-Rec-Lab: (0-3-2)  Semesters Offered: Fall

**AR 1002 National Security Affairs II**  Examines general aspects of air and space power through a historic perspective. Covers from first balloons and dirigibles to the space-age global positioning systems of the Persian Gulf War. Credits: 1.0  Lec-Rec-Lab: (0-1-1)  Semesters Offered: Spring

**AR 2001 Introduction to Leadership**  Introduces application of leadership dynamics, oriented to entry-level management positions and the military. Topics include motivation, training, and effective communication with subordinates. Emphasizes oral presentation and clear writing. Credits: 1.0  Lec-Rec-Lab: (0-2-0)  Semesters Offered: Fall

**AR 2002 Leadership Applications**  Examines leadership application at higher levels of management using the U.S. Army as a model organization. Includes discussion and application of critical reasoning processes to military ethical dilemmas as well as practical exercises in team building, leadership under stress, and human behavior. Credits: 1.0  Lec-Rec-Lab: (0-2-0)  Semesters Offered: Spring

**AR 2011 Leadership Laboratory I**  Covers a combination of practical military skills. Credits: 1.0  Lec-Rec-Lab: (0-0-2)  Semesters Offered: Fall

**AR 2012 Leadership Laboratory II**  Develops a variety of skills through practical experience in military radio communication, assembly and disassembly of selected military weapons, and emergency first aid with emphasis on transporting injured personnel. Credits: 1.0  Lec-Rec-Lab: (0-2-2)  Semesters Offered: Spring

**AR 3001 Small Unit Tactics**  Study of leadership fundamentals, techniques, and practical applications of patrolling, land navigation, and offensive and defensive operations at the squad level. Leadership skills involving fundamentals of marksmanship, operation of communication equipment, drill, and ceremonies. Includes the request for fire support and review of patrolling. Acceptance in ROTC advanced course required. Credits: 1.0  Lec-Rec-Lab: (0-3-0)  Semesters Offered: Fall

**AR 3002 Advanced Military Tactics**  Study of the leadership fundamentals, techniques, and practical application of patrolling and offensive and defensive operations at the platoon level. Also includes review of drill and ceremonies. Credits: 1.0  Lec-Rec-Lab: (0-2-0)  Semesters Offered: Fall

Army ROTC (AR)

**AR 1001 Today's Army**  Orientation to the organization and function of the U.S. Army, including rank structures, branches, and customs. Emphasizes leadership, organization, and communication in small groups. Introduces the role of the National Guard and reserve forces. Credits: 1.0  Lec-Rec-Lab: (0-1-0)  Semesters Offered: Fall

**AR 1002 Map Reading/Land Navigation**  Application of basic principles of map reading, emphasizing terrain association and evaluation, map margin information, topographic symbols, methods of orienteering, and determination of locations using intersection and resection techniques. Credits: 1.0  Lec-Rec-Lab: (0-1-0)  Semesters Offered: Spring

**AR 1011 Fall Adventure Training**  Hands-on practice of military skills, including rappelling, weapons familiarization, land navigation skills, river crossing techniques, and using tactical radios. Students can participate in field exercises, including a white-water rafting trip. Credits: 1.0  Lec-Rec-Lab: (0-2-0)  Semesters Offered: Fall

**AR 1012 Spring Adventure Training**  Learn winter survival techniques. Winter cross-country movement techniques using military skis and snowshoes. Application of military map reading and land navigation techniques, including an introduction to orienteering. Emphasizes use of the military lenticular compass and the protractor compass, elevation and relief, and terrain association. Credits: 1.0  Lec-Rec-Lab: (0-2-0)  Semesters Offered: Spring

**AR 1059 AROTC Marksmanship Training**  Develops marksmanship skills through individual practice and competition among individuals, and records fire for qualification. Emphasizes awareness of firearms safety and leadership responsibility for marksmanship training. Credits: 1.0; repeatable to a max of 4.  Lec-Rec-Lab: (0-0-2)  Semesters Offered: Fall

**AR 1068 Physical Conditioning**  Develops physical fitness, personal confidence, and military skills. Covers both individual and group physical fitness procedures and techniques. Emphasizes developing a good fitness program for each individual. Students also enroll in an appropriate-level recitation class. Credits: 1.0; repeatable to a max of 12.  Lec-Rec-Lab: (0-0-2)  Semesters Offered: Fall

**AR 1075 Ranger Challenge**  The varsity sport of ROTC in which teams compete in technical, tactical, and leadership skills. The competition provides mental and physical challenges with goals of training excellence, discipline, and victory. Enrollment in ROTC required. Credits: 1.0; repeatable to a max of 4.  Lec-Rec-Lab: (0-0-2)  Semesters Offered: Fall

**AR 2001 Introduction to Leadership**  Introduces application of leadership dynamics, oriented to entry-level management positions and the military. Topics include motivation, training, and effective communication with subordinates. Emphasizes oral presentation and clear writing. Credits: 1.0  Lec-Rec-Lab: (0-2-0)  Semesters Offered: Fall

Business Administration (BA)

**BA 1200 IS/IT Fundamentals**  Covers basic concepts underlying information technology. Introduces systems concepts, information technology, application software, and programming using an industry standard programming language. Introduces information use in organizations and how information technology enables improvements in the quality and timeliness of information. Credits: 3.0  Lec-Rec-Lab: (0-2-1)  Semesters Offered: Fall

**BA 1700 Business Orientation**  Orientation to the School of Business and Economics. Describes the business concentrations offered by the School, explains the BSBA curriculum, outlines career and professional development options and expectations, and discusses career and academic advising opportunities. Credits: 1.0  Lec-Rec-Lab: (0-1-0)  Semesters Offered: Spring

**BA 2100 Business Statistics**  Introduction to basic concepts and methods of probability and statistics, including the following topics: collection, description and presentation of data, probability, random variables, sampling, probability distributions, estimation and hypothesis testing, ANOVA, and selected nonparametric techniques. Credits: 3.0  Lec-Rec-Lab: (3-0-0)  Semesters Offered: Fall

**BA 2110 Quantitative Problem Solving**  Stresses development of quantitative decision and analysis skills to solve problems with cases, exercises, simulations, and mathematical modeling. Topics include regression analysis, decision analysis, stochastic environments, data sources and errors, utility theory risk preference, linear programming, and simulation analysis. Credits: 3.0  Lec-Rec-Lab: (3-0-0)  Semesters Offered: Fall

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BA 2200 Business Programming Concepts
Develops business problem-solving skills through the application of a commonly used high-level business programming language. Topics include the nature of the business programming environment, fundamentals of the language (e.g., programming constructs, data management, manipulation of simple data structures), structured programming concepts, desirable programming practices and design, debugging and testing techniques. Credits: 3.0
Lec-Rec-Lab: (3-0-0) Semester(s) Offered: Spring
Prerequisites: BA 1200 or CS 1112 or CS 1131

BA 2300 Accounting Principles I
Introduction to basic principles, concepts, and theoretical framework of financial accounting with the emphasis on its use by economically rational decision makers. Topics include the decision-making environment and the accounting cycles, processes, and statements. Credits: 3.0
Lec-Rec-Lab: (3-0-0) Semester(s) Offered: Fall
Prerequisites: May not be enrolled in one of the following Classes(s): Freshman

BA 2310 Accounting Principles II
Emphasizes the role of accounting information within a firm. Topics include budgeting, responsibility accounting, cost allocations, cost behavior, decision models, capital budgeting, and an introduction to product costing in manufacturing and service sector firms. Credits: 3.0
Lec-Rec-Lab: (3-0-0) Semester(s) Offered: Fall
Semester(s) Offered: Spring
Prerequisites: May not be enrolled in one of the following Classes(s): Freshman

BA 2500 Business Law I
Provides an understanding of the legal basis of contracts and their enforcement in the areas of general contracts, contracts of commercial sales and of agency, and commercial paper. Credits: 3.0
Lec-Rec-Lab: (3-0-0) Semester(s) Offered: Fall
Prerequisites: UN 2002

BA 2700 Business Problem Solving
Develops individual and group problem-solving skills using active, hands-on learning. Emphasizes problem identification and problem solution under conditions of ambiguity and uncertainty. Stresses creativity, interpersonal skills and assessment, communication, group process, and teamwork, and action planning. Credits: 4.0
Lec-Rec-Lab: (0-4-0) Semester(s) Offered: Fall
Semester(s) Offered: Summer
Prerequisites: May not be enrolled in one of the following Classes(s): Freshman

BA 3200 IS/IT Management
Focuses on the theory and application of the information-systems discipline to organizations and roles of management, users, and information systems professionals. Covers the role of telecommunications and distributed systems for business, the use of information and its implications for decision support in organizations, and the ethical, legal, and social issues of IT. Credits: 3.0
Lec-Rec-Lab: (3-0-0) Semester(s) Offered: Fall
Semester(s) Offered: Spring
Prerequisites: BA 3200(C)
and BA 1200 and (BA 2200 or CS 1112 or CS 1132)

BA 3210 Business Database Management
Emphasizes database principles that are constant across different database software products through concrete examples using a relational database management system. Provides a well-rounded business perspective about developing, utilizing, and managing organizational databases. Credits: 3.0
Lec-Rec-Lab: (0-3-0) Semester(s) Offered: Fall
Semester(s) Offered: Spring
Prerequisites: BA 3200(C)
and BA 1200 and (BA 2200 or CS 1112) or permission of instructor

BA 3220 Systems Analysis and Design
Provides an understanding of the IS development and modification process and the evaluation choices of a system development methodology. Emphasizes effective communication with users and team members and other associated with the development and maintenance of the information system. Stresses analysis and logical design of departmental-level information system. Credits: 3.0
Lec-Rec-Lab: (3-0-3) Semester(s) Offered: Spring
Prerequisites: BA 3210

BA 3290 Special Topics in IS/IT
Examines current IS/IT topics and issues in greater depth from a managerial perspective. A single offering of this course will concentrate on one or two topics, which will vary. Credits: 3.0; repeatable to a max of 6
Lec-Rec-Lab: (0-3-0) Semester(s) Offered: Fall
Prerequisites: BA 3290

BA 3300 Accounting Theory/Practice I
Studies the theory, concepts, and practices underlying financial reporting and measurement. Primary focus is on income measurement, and the valuation of assets, like cash, receivables, inventory, and long-lived assets, as well as multinationals issues. Credits: 3.0
Lec-Rec-Lab: (0-3-0) Semester(s) Offered: Fall
Prerequisites: BA 2310

BA 3310 Accounting Theory/Practice II
A continuation of BA 3300 with theories, concepts, and practices underlying financial measurement and reporting. Focuses on the measurement and reporting of liabilities and equities, and includes multinationals issues. Credits: 3.0
Lec-Rec-Lab: (0-3-0) Semester(s) Offered: Spring
Prerequisites: BA 3300 and BA 3400

BA 3320 Cost Accounting
Emphasizes traditional and contemporary product costing techniques, cost allocation practices, and basic cost-management issues. Topics include process costing, standard costing, activity-based costing, backflush costing, cost-allocation practices and issues, and the role of accounting in contemporary management practices. Credits: 3.0
Lec-Rec-Lab: (0-3-0) Semester(s) Offered: Fall
Prerequisites: BA 2310

BA 3400 Managerial Finance
Introduction to the principles of finance. Topics include financial mathematics, capital acquisition, the capital investment decision, financial assets valuation, and working capital management. Credits: 3.0
Lec-Rec-Lab: (3-0-0) Semester(s) Offered: Fall
Semester(s) Offered: Spring
Semester(s) Offered: Summer
Prerequisites: BA 2310 and (BA 2100 or MA 2710 or MA 3710) or permission of instructor

BA 3570 Organized Labor Law
Provides an understanding of the legal foundation of labor-management relations and the processes to implement statutory requirements (representation and contract agreements and their administration). Credits: 3.0
Lec-Rec-Lab: (3-0-0) Semester(s) Offered: Fall; offered alternate years beginning with the 2001-02 academic year
Restrictions: Must be enrolled in one of the following Classes(s): Junior Senior
Prerequisites: UN 2002

BA 3580 Legal Environment of Business
Provides an understanding of the regulatory environment of business and the constitutional protections of property and conduct. Credits: 3.0
Lec-Rec-Lab: (3-0-0) Semester(s) Offered: Fall
Restrictions: Must be enrolled in one of the following Classes(s): Junior Senior
Prerequisites: UN 2002

BA 3590/MG 3690 Business Law II
Continuation of BA 3500. Provides an understanding of the legal basis of property (personal and real) and business organizations as well as their formation, function, and discharge. Credits: 3.0
Lec-Rec-Lab: (3-0-0) Semester(s) Offered: Spring
Prerequisites: BA 2500

BA 3610 Operations Management
Focuses on the principles of operations management for both manufacturing and service industries. This include strategy, forecasting, design, quality, processes, capacity, planning, location, layout, human, supply chain, inventory, JIT, MRP scheduling, project, and maintenance management. Emphasizes the integration of all these decisions with the rest of management. Credits: 3.0
Lec-Rec-Lab: (3-0-0) Semester(s) Offered: Fall
Semester(s) Offered: Spring
Prerequisites: BA 3200 or MA 2710 or MA 3710

BA 3690 Management Science
Explains how management science or operations research works. Learn how to use tools such as linear and integer programming, queuing theory, inventory theory, PERT/CPM, decision theory, decision theory, and dynamic programming. Credits: 3.0
Lec-Rec-Lab: (3-0-0) Semester(s) Offered: Spring
Prerequisites: BA 2100 or MA 2710 or MA 3710

BA 3700 Organizational Behavior
Covers concepts of human relations and organizational behavior through the study of people's behavior at work. Develops understanding, attitudes, and skills leading to increased personal effectiveness. Credits: 3.0
Lec-Rec-Lab: (3-0-0) Semester(s) Offered: Fall
Semester(s) Offered: Spring
Restrictions: Must be enrolled in one of the following Classes(s): Junior Senior
Prerequisites: BA 2700 or permission of instructor

BA 3780 Entrepreneurship
Covers management issues associated with establishing a successful new enterprise as a small businesses or part of an existing firm. Create a business plan. Case studies develop understanding of opportunity recognition, entrepreneurial teams, reward systems, financing alternatives, family ventures, ethical and legal contractual considerations, and resource needs. Credits: 3.0
Lec-Rec-Lab: (1-2-0) Semester(s) Offered: Spring
Semester(s) Offered: Summer
Restrictions: Must be enrolled in one of the following Classes(s): Junior Senior

BA 3790 Business Communication
Emphasizes written reports and oral presentation skills needed for effective communication. Examines technologies supporting written and oral communication in the workplace, along with ethical and international considerations. Credits: 3.0
Lec-Rec-Lab: (2-1-0) Semester(s) Offered: Spring
Semester(s) Offered: Summer
Restrictions: Must be enrolled in one of the following Classes(s): Junior Senior
Prerequisites: UN 2001

BA 3800 Principles of Marketing
Emphasizes decisions made in developing both strategic and tactical marketing plans. Uses computer simulations, experiential learning assignments, and marketing plan development to demonstrate principles of market segmentation, product development, pricing, distribution planning, and promotion. Credits: 3.0
Lec-Rec-Lab: (3-0-0) Semester(s) Offered: Fall
Semester(s) Offered: Summer
Restrictions: Must be enrolled in one of the following Classes(s): Junior Senior

BA 3900 Business Internship
A practical approach to business problem solving. Requires a report on work activity upon completion of the internship. Credits: variable to 4.0; repeatable to a max of 4
Lec-Rec-Lab: (0-0-0) Semester(s) Offered: Fall
Semester(s) Offered: Summer
Restrictions: Permission of instructor required; must be enrolled in one of the following College(s): School of Business and Economics

BA 4200 Data Communications/Networking
Studies the theory and practice of development and implementation of distributed systems in organizations at both the hardware and software levels. Addresses network implementation and administration, telecommunications, client/server information systems, distributed database, graphical user interface development, and the managerial implications of globally distributed communications and information systems. Credits: 3.0
Lec-Rec-Lab: (0-3-0) Semester(s) Offered: Fall
Prerequisites: BA 3220(C)

BA 4210 Strategic IT for Organizational Change
Focuses on understanding IT’s impact and enabling role in transforming organizations, case analysis to develop a framework for innovative IT use, and understanding IT as a tool for sustainable competitive advantage. Credits: 3.0
Lec-Rec-Lab: (0-3-0) Semester(s) Offered: Spring
Restrictions: Must be enrolled in one of the following Major(s): Business Administration; must be enrolled in one of the following Classes(s): Senior Prerequisites: BA 4200 and BA 3700
BA 4250 Information Systems Projects MIS capstone course. Previous completion of MIS electives and BSBA technology corequirement required. Applies IS concepts as solutions to business problems using project teams and faculty project manager supervision. Emphasizes the latter portion of the systems development life cycle project management within an IS context. Credit: 3.0 Lec-Rec-Lab: (0-3-0) Semester Offered: Spring; Restrictions: Must be enrolled in one of the following Major(s): Business Administration; must be enrolled in one of the following Class(es): Senior Prerequisites: BA 4200

BA 4300 Attestation and Assurance Auditing procedures and techniques associated with public accounting and with internal auditing for business entities. Topics include auditor's responsibilities, professional ethics, generally accepted auditing standards, purpose and types of audits, objectives, internal control, evidence, organization within the public accounting profession, the audit program, and auditing procedures and techniques. Credit: 3.0 Lec-Rec-Lab: (0-3-0) Semester Offered: Spring Restrictions: Must be enrolled in one of the following Class(es): Senior Prerequisites: BA 3310

BA 4310 Foundations of Taxation Introduction to basic principles, concepts, and theoretical framework of taxation systems, emphasizing income taxation and its impact on decision making. Topics include tax planning and compliance for individuals, corporations, and partnerships. Credit: 3.0 Lec-Rec-Lab: (0-3-0) Semester Offered: Fall Prerequisites: BA 2310

BA 4350 Advanced Tax Topics Continuation of BA4310. Introduction to advanced principles and concepts of taxation, emphasizing income taxation and its impact on decision making. Topics include tax planning and compliance for estates and trusts, gratuitous transfers, multijurisdictional operations, and entity formations, liquidations, and reorganizations. Credit: 3.0 Lec-Rec-Lab: (0-3-0) Semester Offered: Spring Prerequisites: BA 4310

BA 4360 Accounting Systems Introduction to the basic principles, concepts, and theoretical framework for the design and operation of accounting information systems, emphasizing its use to enhance decision making. Topics include control design, internal control, the use of databases, and electronic commerce. Credit: 3.0 Lec-Rec-Lab: (0-3-0) Semester Offered: Spring Prerequisites: BA 2310 and BA 3200 or permission of instructor

BA 4370 Advanced and Governmental Accounting Advanced measurement and financial reporting problems encountered by accountants. Topics include the Statement of Cash Flows, consolidations and mergers, partnerships, governmental and not-for-profit organizations, and foreign operations. Credit: 3.0 Lec-Rec-Lab: (0-3-0) Semester Offered: Fall Prerequisites: BA 3310

BA 4380 Accounting Theory Analysis and evaluation of contemporary accounting thought. Explores current topics through readings, independent research, and discussions. Emphasizes concepts rather than procedures. Credit: 3.0 Lec-Rec-Lab: (0-3-0) Semester Offered: Spring Prerequisites: BA 4370

BA 4390 Contemporary Cost Management Emphasizes valuation considerations. Emphasizes study of correction management, decision-making, and strategic-planning processes. Covers contemporary control and evaluation practices (such as activity-based management), determining the costs of quality, and productivity analysis in the context of accounting information systems. Credit: 3.0 Lec-Rec-Lab: (0-3-0) Semester Offered: Spring Prerequisites: BA 3320

BA 4400 Investment Analysis Operations of the stock market, bond market, and other financial markets. Stock and bond valuation techniques, financial markets and institutions, and investment opportunities. Credit: 3.0 Lec-Rec-Lab: (0-3-0) Semester Offered: Spring Prerequisites: BA 3400 or EC 3400 or permission of instructor

BA 4410 Advanced Financial Management Advanced topics in managerial finance: working capital management, capital budgeting, investment analysis, portfolio theory, and other topics. Includes case studies, classroom discussion, use of the computer in financial modeling, and other financial applications. Credit: 3.0 Lec-Rec-Lab: (0-3-0) Semester Offered: Fall Prerequisites: BA 3400

BA 4460 Derivatives and Financial Engineering Covers the pricing and use of options, financial futures, swaps, and other derivative securities. Credit: 3.0 Lec-Rec-Lab: (0-3-0) Semester Offered: Fall Prerequisites: BA 3400

BA 4470 Applied Portfolio Management Covers issues in the management and administration of investments in an institutional setting. Students manage a real portfolio of financial assets. Credit: variable to 3.0; repeatable to a max of 6 Lec-Rec-Lab: (0-0-0) Semester Offered: Fall Spring Restrictions: Permission of instructor required; must be enrolled in one of the following Class(es): Junior Senior Prerequisites: BA 3400

BA 4480 Global Finance Studies international financial systems and markets. Covers the principles of comparative advantage, balance of payments, exchange rate systems, theories of international finance, identification of economic risk and factors that affect management and risk of international finance. Credit: 3.0 Lec-Rec-Lab: (0-3-0) Semester Offered: Spring; offered alternate years beginning with the 2001-2002 academic year Prerequisites: BA 3400 or permission of instructor

BA 4490 Personal Financial Planning Provides students with an overview of personal financial services and instruments offered by economic and financial institutions. Topics include the personal financial environment, employee compensation, personal investments and asset management, tax planning, the development of an adequate but cost-effective insurance program, and retirement planning. Credit: 3.0 Lec-Rec-Lab: (0-3-0) Semester Offered: Spring Restrictions: Must be enrolled in one of the following Class(es): Junior Senior Prerequisites: BA 3400 or EC 3400 or permission of instructor

BA 4570 Employment Law Provides an understanding of the statutory environment of organized labor and employment discrimination, along with labor-management processes for work agreements and dispute settlement. Credit: 3.0 Lec-Rec-Lab: (0-3-0) Semester Offered: Fall; offered alternate years beginning with the 2000–2001 academic year Restrictions: Must be enrolled in one of the following Class(es): Junior Senior Prerequisites: UN 2002

BA 4580 Law of Technology Provides an understanding of the statutory requirements for protection of intellectual property, including patent, copyright, trademark, and trade secrets, along with derivative statutes, and obligations imposed by licensing of rights. Credit: 3.0 Lec-Rec-Lab: (0-3-0) Semester Offered: Spring; offered alternate years beginning with the 2000–2001 academic year Restrictions: Must be enrolled in one of the following Class(es): Junior Senior Prerequisites: UN 2002

BA 4590 Environmental Law Provides an understanding of the structure and terminology of environmental protection statutes, the regulatory approach to implementing their coverage, and the deployment and terminology of international environmental relations. Credit: 3.0 Lec-Rec-Lab: (0-3-0) Semester Offered: Spring; offered alternate years beginning with the 2001-2002 academic year Restrictions: Must be enrolled in one of the following Class(es): Junior Senior Prerequisites: UN 2002

BA 4600 Management of Technology Studies technology development, methods of technological forecasting and management, implementation of new technology, technology transfer, strategy, technology management and international technology management issues. Two credits with no research report; three credits with a report on a company’s technology strategy or the competitive technology development in a selected product/service group. Credit: variable to 3.0 Lec-Rec-Lab: (0-0-0) Semester Offered: Fall Spring Restrictions: Must be enrolled in one of the following Class(es): Senior Prerequisites: EC 2000 or permission of instructor

BA 4610 Project Management Focuses on application of systems analysis to project definition and selection. Covers project management, their structures, and implementation of strategies. Examines international studies of project management, communication in technological project management, project management planning, scheduling, and control tools; project monitoring, evaluation, and termination; multiple project management and interproject relations. Case study of new product process development. Requires case study reports. Credit: 3.0 Lec-Rec-Lab: (0-3-0) Semester Offered: Fall Spring Restrictions: Must be enrolled in one of the following Class(es): Senior Prerequisites: BA 3600 and BA 3800

BA 4620 Supply Chain Management Designing and managing channels of distribution, purchase and movement of goods, and transportation systems. Emphasizes design of supply chain management, product design, and strategic marketing. Credit: 3.0 Lec-Rec-Lab: (0-3-0) Semester Offered: Spring Prerequisites: BA 3600 and BA 3800

BA 4660 Systems Quality Management Stressors concepts and tools used to manage interrelationships among several functional units. Emphasizes quality function deployment and related tools, such as experimental designs, failure mode analysis, etc. Credit: 3.0 Lec-Rec-Lab: (0-3-0) Semester Offered: Fall; offered alternate years beginning with the 2000–2001 academic year Prerequisites: BA 3600

BA 4670 Discrete Event Simulation Introduction to discrete-event digital simulation to solve management problems with the use of special-purpose software. Credit: 3.0 Lec-Rec-Lab: (0-3-0) Semester Offered: Fall Spring Restrictions: Must be enrolled in one of the following Class(es): Senior Prerequisites: BA 3600

BA 4680 International Technology Management Comparative international studies of economic and managerial aspects of technological innovation. Analyzes the economics and structures of management for international technological projects. Credit: 2 credits without a research report; 3 credits with a research report. Credit: 3.0 Lec-Rec-Lab: (0-3-0) Semester Offered: Fall Prerequisites: BA 2100 or MA 2170 or MA 3710

BA 4690 Systems Thinking and Dynamic Modeling Systems thinking concepts are applied to understand the complex feedback relationships that exist within a dynamic system. Credit: 3.0 Lec-Rec-Lab: (0-3-0) Semester Offered: Spring Restrictions: Must be enrolled in one of the following Class(es): Junior Senior Prerequisites: BA 4600

BA 4700 Business Policy Focuses on the interrelationship of the various functions of the business organization as it relates to strategic planning. Credit: 3.0 Lec-Rec-Lab: (0-3-0) Semester Offered: Fall Spring Restrictions: Must be enrolled in one of the following Class(es): Senior Prerequisites: BA 3200 and BA 3400 and BA 3600 and BA 3700 and BA 3800 or permission of instructor

BA 4710 International Management Study of managing work in a global context. Assesses impact of culture and the international environment (economic, social, legal, technological) on management, personnel, marketing, accounting, and finance strategies. Examines the creation of business structures for international expansion and ventures. Develops attitudes and skills leading to increased international effectiveness. Credit: 3.0 Lec-Rec-Lab: (0-3-0) Semester Offered: Spring Prerequisites: Must be enrolled in one of the following Class(es): Senior Prerequisites: BA 3700 and EC 3100 and BA 3400 and BA 3800 or permission of instructor
BA 4750 Managing Change Requires a study of organizational change management. Emphasizes leadership in envisioning, implementing, and managing resistance to change. Focuses on leadership and change management within the framework of transformational leadership, empowerment, commitment, teamwork, and culture change, and on mastering tools and techniques to facilitate large-scale organizational change. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Spring Restrictions: Must be enrolled in one of the following Class(es):] unior Senior Prerequisites: BA 3700 or permission of instructor

BA 4760 Strategic Leadership Study and practice of leadership in organizations. Topics include leadership styles, teams, task and relationship skills, personality, power, conflict management, feedback techniques, planning, decision making, and follower-situation attributes. Various leadership theories are discussed and applied to leaders. Includes significant self-evaluation of leadership traits. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Fall Spring Summer Restrictions: Must be enrolled in one of the following Class(es):] unior Senior Prerequisites: UN 2002

BA 4770 Human Resource Management Examines methods that organizations use to meet organizational goals through influencing worker attitudes, behaviors, and performance. Topics include recruitment, selection, training, performance appraisal, and compensation. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Spring Restrictions: Must be enrolled in one of the following Class(es):] unior Senior Prerequisites: BA 3700

BA 4780 International Business Communications Studies the importance of intercultural communication competence for effective business relationships. Provides a theoretical and practical foundation for successful business communication by examining the communication processes and contextual units. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Spring Summer Restrictions: Must be enrolled in one of the following Class(es):] Senior Prerequisites: UN 1001 and (UN 1002 or UN 1003) and UN 2001 and UN 2002 or permission of instructor

BA 4790 Ecological Sustainability and Organizations Examines the problems and solutions associated with creating and maintaining ecologically sustainable organizations (primarily businesses). Builds an ethical framework using concepts of ecological identity and place and examines the principles of ecological economics and sustainable development. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Spring Restrictions: Must be enrolled in one of the following Class(es):] Senior Prerequisites: UN 2002

BA 4800 Business Research Focuses on research to help make better business decisions. Includes the study of qualitative and quantitative research methods, survey research methodology, potential sources of error, statistical analysis, and using SPSS. Cases or practical research are used to give experience in business research methods. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Fall Spring Summer Restrictions: Must be enrolled in one of the following Class(es):] Senior Prerequisites: BA 2110 or MA 2710 or MA 3710 and BA 3800 or permission of instructor

BA 4840 Industrial Marketing Focuses on marketing and purchasing of goods and services in industrial markets. Includes pricing issues, distribution, product planning and value analysis, inventory management, and legal issues. Examines the implications of these issues to industrial buyers and industrial marketers. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Spring Restrictions: Must be enrolled in one of the following Class(es):] Senior Prerequisites: BA 3800 or permission of instructor

BA 4860 Buyer Behavior Focuses on understanding behavior of buyers as members of relevant groups, subcultures, and national and global cultures. Emphasizes converting theories of behavior into models of behavior in industries/markets of interest to the students. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Spring Restrictions: Must be enrolled in one of the following Class(es):] Senior Prerequisites: BA 3800 or permission of instructor

BA 4870 Advertising/Sales Promotion Studies how advertising and sales promotion campaigns (for both consumer and industrial goods) are created, produced, distributed, and measured. Emphasizes roles played by clients, various components of advertising agencies, and media companies. Focuses on experiential learning using group projects for real clients (often a nonprofit). Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Fall Restrictions: Must be enrolled in one of the following Class(es):] Senior Prerequisites: BA 3800 or permission of instructor

BA 4880 Sales and Sales Management Looks at the role of the selling function as an integral part of the total marketing effort. Examines the administrative functions of sales management, the dynamics of the buying-selling process, and sales strategies and tactics. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Fall Restrictions: Must be enrolled in one of the following Class(es):] Senior Prerequisites: BA 3800 or permission of instructor

BA 4900 Research and Special Projects Under the general guidance of a faculty member, students read, conduct research, and prepare reports and papers. The SBE's Curriculum Committee must approve the subject of the proposed project. Credits: variable to 4.0; repeatable to a max of 6 Lec-Rec-Lab: (0-0-0) Semesters Offered: On Demand Restrictions: Permission of instructor and department required; must be enrolled in one of the following Class(es):] Senior

BA 4990 Special Topics in Business Business topics of interest to students and faculty. Credits: variable to 4.0; repeatable to a max of 6 Lec-Rec-Lab: (0-0-0) Semesters Offered: On Demand Restrictions: Permission of instructor required; must be enrolled in one of the following Class(es):] Senior

BE 3500 Biomedical Materials An overview of biomaterials in three basic classes: metals, ceramics, and polymers. Topics include biomaterials used in special medical applications (such as tissue replacement, absorbable and non-absorbable sutures, and soft tissue replacements) as well as discussion of tissue, body, and blood response to implants (bio-compatibility). Credits: 3.0 Lec-Rec-Lab: (2-0-2) Semesters Offered: Fall Restrictions: Must be enrolled in one of the following Major(s): Engineering-Biomedical Engineering-Biomedical Prerequisites: BL 2020 and BL 2101 and MY 2100

BE 3600 Biomedical Instrumentation Introduction to theory of measurement and analysis of biological systems. Covers use of transducers, integrated circuits, signal processing computer interfacing, signal display and analysis, data acquisition and controls. Laboratory includes measurement and analysis of biological systems. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Spring Restrictions: Must be enrolled in one of the following Major(s): Engineering-Biomedical Engineering-Biomedical Prerequisites: BL 2020

BE 3750 Human Biomechanics Introduction to the analysis of anatomical structures, movements, and mechanics of the musculoskeletal system, including properties and strength of materials. Includes application of Newtonian mechanics, statics, and strength of materials of bone, muscle, tendon, and other biologic materials. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Spring Restrictions: Must be enrolled in one of the following Major(s): Engineering-Biomedical Engineering-Biomedical Prerequisites: BL 2020

BE 4210 Exercice Physiology Focuses on the functional changes brought by acute and chronic exercise sessions. Topics include muscle structure and function, bioenergetics, cardiovascular and respiratory adaptations, exercise training for sport, sport nutrition, ergogenic aids, and other health and fitness topics. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Fall Restrictions: Must be enrolled in one of the following Major(s): Engineering-Biomedical Engineering-Biomedical Prerequisites: BL 2020

BE 4550 Aerospace Physiology Focuses on the effects of space flight on human physiology. Topics include the effects of micro-gravity on skeletal muscle, bone, and the cardiovascular respiratory, vestibular, and immune systems. Discusses counter measures for long duration space travel. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Spring Restrictions: Must be enrolled in one of the following Class(es):] Senior Corequisites: BE 4920

BE 4900 Biomedical Design Project I A team approach is used to resolve a defined problem in biomedical engineering. Projects are selected and undertaken with faculty and/or industrial-sponsor guidance. Requires project notebooks, oral and written proposals, progress reports, and final presentations. Credits: 3.0 Lec-Rec-Lab: (1-1-3) Semesters Offered: Fall Restrictions: Must be enrolled in one of the following Major(s): Engineering-Biomedical Engineering-Biomedical Engineering-Biomedical Engineering-Biomedical Prerequisites: BL 2020 and permission of instructor

BE 4910 Biomedical Design Project II Continuation of Biomedical Design Project I (BE4900) under faculty and/or an industrial-sponsor. Emphasizes design and testing of prototypes. Requires written project notebooks, oral and written reports, and presentations. Credits: 3.0 Lec-Rec-Lab: (1-1-3) Semesters Offered: Spring Restrictions: Must be enrolled in one of the following Class(es):] Senior Corequisites: BE 4920

BE 4920 Professional Development This multi-topic course prepares the student for professional practice. Modules will cover professional licensing, ethics, intellectual property, regulatory requirements, and other nontechnical aspects of the biomedical engineering profession. Credits: 3.0 Lec-Rec-Lab: (0-0-0) Semesters Offered: Fall Spring Restrictions: Permission of instructor required; must be enrolled in one of the following Class(es):] Senior Corequisites: BE 4920

BE 4930 Biomedical Engineering Topics Biomedical engineering courses will be offered as professional electives dependent upon the interest of the faculty, and/or special undergraduate research on specific problems where research credits may be granted. Credits: variable to 6.0 May be repeated Lec-Rec-Lab: (0-0-0) Semesters Offered: Fall Spring

BL 0600 Clinical Practicum and Career Preparation Seminar Presents an overview of hospital-based clinical practicum experiences and outlines pathways to national certification. Also addresses career options for the clinical laboratory scientist. Credits: 1.0; graded Pass/Fail only Lec-Rec-Lab: (0-1-0) Semesters Offered: Spring Restrictions: Must be enrolled in one of the following Major(s): Clinical Laboratory Science; may not be enrolled in one of the following Class(es):] Freshman General Biology I A discussion of the principles of organismal biology including solutions to physiological problems commonly encountered by plants and animals. Topics include nutrient acquisition and processing, gas and fluid balance, internal transport, control systems, reproduction, and behavior. Credits: 4.0 Lec-Rec-Lab: (3-0-3) Semesters Offered: Fall Restrictions: Must be enrolled in one of the following Major(s): Biomedical Sciences, Clinical Laboratory Science General Biology II Discussion of the major principles by which life is organized. Topics include scientific methods, biological chemistry, cell structure and organization, multicellular organization, diversity of organisms, energetics and photosynthesis, cellular reproduction genetics, gene structure and expression, and recombinant DNA. Credits: 4.0 Lec-Rec-Lab: (3-0-3) Semesters Offered: Spring Restrictions: Must be enrolled in one of the following Major(s): Biomedical Sciences, Clinical Laboratory Science Corequisites: Bl 1010 or permission of instructor
BL 1040 Principles of Biology Basic principles through which biological systems operate. Topics include cell biology, structure, and function; energy production, genetics, physiology, diversity, evolution, and ecology. Credits: 4.0 Lec-Rec-Lab: (3-0-2) Semesters Offered: Fall Restrictions: May not be enrolled in one of the following Major(s): Biological Sciences, Clinical Laboratory Science.

BL 1060 Fundamentals of Biology Discusses fundamentals of cellular and organismal biology. Topics include cell biochemistry, structure, and function; energy production, genetics; and physiology. Credits: 1.0 Lec-Rec-Lab: (1-0-0) Semesters Offered: Fall Restrictions: Must be enrolled in one of the following Major(s): Civil Engineering, Environmental Engineering.

BL 1580 Introduction to Biological Sciences Introduction to fields and career opportunities in the biological sciences. Credits: 1.0 Lec-Rec-Lab: (0-1-0) Semesters Offered: Fall

BL 1590 Introduction to Pre-Medicine Introduction to various careers in the medical field. Discusses required course work, entrance exams, and other requirements for entry to the various fields. Guest lecturers include representatives of many medical fields. Credits: 1.0 Lec-Rec-Lab: (1-0-0) Semesters Offered: Fall

BL 1600 Introduction to Clinical Laboratory Science Introduction to subspecialties, the clinical practicum, career opportunities, and current issues in clinical laboratory science. Credits: 1.0 Lec-Rec-Lab: (0-1-0) Semesters Offered: Fall

BL 1710 Medical Terminology Autotutorial course covers the fundamentals of medical terminology, including pre- and post-suffices, as well as single-syllable words. Exercises also include spelling and pronunciation. Credits: 1.0 Lec-Rec-Lab: (0-1-0) Semesters Offered: Fall

BL 2010 Anatomy Physiology I Comprehensive introductory course in vertebrate anatomy and physiology with emphasis on the human body. Interrelates structure with function in regard to maintaining homeostasis and normal functioning of the body. Covers the integument, skeletal system, nervous system, muscles, and the endocrine system. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Fall Prerequisites: CH 1110 or permission of instructor

BL 2011 Anatomy Physiology I Lab The laboratory to accompany BL2010. Examines embryology, muscle and skeletal anatomy, and neuroanatomy. Explores the physiology of the nervous system, including vision and reflexes and muscle physiology. A student-designed lab project is used to teach experimental design. Credits: 1.0 Lec-Rec-Lab: (0-0-3) Semesters Offered: Fall Prerequisites: BL 2010(C)

BL 2020 Anatomy Physiology II Continuation of BL2010. Covers the cardiovascular, respiratory, digestive, renal, and reproductive systems. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Spring Prerequisites: BL 2010 or permission of instructor

BL 2021 Anatomy Physiology II Lab The laboratory to accompany BL2020. Examines the structure and function of the digestive, respiratory, cardiovascular, and renal systems. A student-designed lab project is used to teach experimental design. Credits: 1.0 Lec-Rec-Lab: (0-0-3) Semesters Offered: Spring Prerequisites: BL 2011 and BL 2020(C)

BL 2100 Principles of Biochemistry Introductory overview to biochemistry. Topics include the biochemistry of amino acids, lipids, carbohydrates, nucleic acids, and water, as well as bioenergetics and photosynthesis. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Fall Prerequisites: BL 1040 or BL 1020 and CH 1110

BL 2160 Botany Covers structure, function, reproduction, and classification of plants and algae, bryophytes, and vascular plants. Credits: 4.0 Lec-Rec-Lab: (3-0-3) Semesters Offered: Spring

BL 2170 Zoology A discussion of the biology of animals, including the origins and evolution of the metazoa phyla, their physiology, development, ecology, behavior, natural history, and systematics. Emphasizes invertebrates other than insects. Credits: 4.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Fall Prerequisites: BL 1010 or BL 1040

BL 2200 Genetics A study of classical and molecular genetics. Topics include one- and two-locus genetics, recombination, genetostream, regulation and function, quantitative and population genetics, and genetic engineering. Covers both prokaryotes and eukaryotes. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Spring Prerequisites: BL 1020 or BL 1040 and BL 2100 or permission of instructor

BL 2210 Genetics Laboratory A laboratory to complement BL2200. Covers applications of techniques used in genetics, including Mendelian analysis, tetrad analysis, karyotyping, DNA and protein electrophoresis, DNA and plasmid purification, transformation and restriction mapping, and PCR amplification of DNA. Credits: 1.0 Lec-Rec-Lab: (0-0-4) Semesters Offered: Spring Prerequisites: BL 2200(C)

BL 2410 Basic Clinical Laboratory Techniques Introduces a variety of fundamental diagnostic procedures performed in a typical clinical laboratory. Credits: 3.0 Lec-Rec-Lab: (2-0-2) Semesters Offered: Fall Restrictions: Must be enrolled in one of the following Major(s): Biological Sciences, Clinical Laboratory Science; may not be enrolled in one of the following Class(es): freshman Prerequisites: UN 2002 or permission of instructor

BL 2940 Human Nutrition Covers basic and applied chemistry and biology of human nutrition. Includes practical information on planning and adopting a healthy diet as well as maintaining acceptable weight. Emphasizes social, global, and environmental issues pertinent to use of the world food supply. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Spring Restrictions: May not be enrolled in one of the following Class(es): freshman Prerequisites: UN 2002 or permission of instructor

BL 2970 Current Health Issues Discusses current topics relevant to human health, including coronary disease, hypertension, hyperlipidemia, smoking cessation, alcohol abuse, obesity, osteoporosis, breast cancer, epididymitis, prostate cancer, anorexia and bulimia, sexually transmitted diseases, and postpartum thyroid dysfunction. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Spring Restrictions: May not be enrolled in one of the following Class(es): Freshman Prerequisites: UN 2002 or permission of instructor

BL 3060 Occupational Hygiene Covers toxic effects of various occupational chemicals, energy forms, and industrial pollutants on human tissues. Emphasizes recognition, evaluation, and control of health hazards in the workplace. Credits: 2.0 Lec-Rec-Lab: (2-0-0) Semesters Offered: Fall Restrictions: May not be enrolled in one of the following Class(es): Freshman Prerequisites: BL 1020 or BL 1040 or BL 1060 or permission of instructor

BL 3190 Evolution A study of the patterns and processes of organic evolution. Topics include genetics of populations, mechanisms of deterministic and stochastic genetic change, history of life on earth, biogeography, molecular evolution, units of selection, sexual selection, speciation, and human evolution. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Fall Prerequisites: BL 1020 or BL 1040

BL 3210 General Microbiology Introduction to the general principles and techniques involved in the study of microorganisms, including bacteria, fungi, and viruses. Topics include cell structure and function, growth, metabolism, biodiversity, and interactions. Credits: 4.0 Lec-Rec-Lab: (3-0-3) Semesters Offered: Fall Restrictions: Must be enrolled in one of the following Class(es): Junior Senior Prerequisites: BL 2100 and BL 1020 or permission of instructor

BL 3230 Medical Bacteriology Study of pathology, identification, isolation and antimicrobial susceptibility testing of clinically important bacteria. Credits: 4.0 Lec-Rec-Lab: (2-0-5) Semesters Offered: Fall Prerequisites: BL 3210

BL 3310 Environmental Microbiology General principles of microbiology, focusing on both the use and control of micro-organisms. Topics include microbial structure, function, growth, metabolism, and diversity, as well as microbial involvement in water and waste treatment, waterborne diseases, and pollution control. Credits: 3.0 Lec-Rec-Lab: (2-0-3) Semesters Offered: Spring Restrictions: May not be enrolled in one of the following Major(s): Biological Sciences Clinical Laboratory Science; must be enrolled in one of the following Class(es): Junior Senior Prerequisites: BL 1060 or BL 1040 or permission of instructor

BL 3400 Principles of Ecology Study of both accepted and currently debated principles that describe ecological relationships at the organism, population, community, and ecosystem levels. Credits: 4.0 Lec-Rec-Lab: (3-0-3) Semesters Offered: On Demand Prerequisites: BL 1020 or BL 1040

BL 3640 General Immunology Investigates the immune defense system that has evolved to protect vertebrates from invading pathogens and cancer. Covers general principals of innate and acquired immunity, immunodeficiency and autoimmune diseases, as well as transplantation immunology, and the role of apoptosis in lymphocyte maturation. Credits: 3.0 Lec-Rec-Lab: (3-0-3) Semesters Offered: Spring Restrictions: Must be enrolled in one of the following Major(s): Biological Sciences Clinical Laboratory Science; may not be enrolled in one of the following Class(es): Freshman Prerequisites: BL 1020

BL 3780 Medical Parasitology Laboratory Stresses the visual identification of common human parasites. Credits: 1.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Spring Restrictions: Must be enrolled in one of the following Major(s): Biological Sciences Clinical Laboratory Science; must be enrolled in one of the following Class(es): Junior Senior Prerequisites: BL 1710 and BL 2410 or permission of instructor

BL 3785/SS 3850 Environmental Toxicology and Society Investigates the social consequences of environmental poisons on human health and communities, with a focus on global effects and the unequal burden of toxic exposure. Toxicology lectures cover testing methods, bioactivation, carcinogenic and teratogenic effects, and target organs. Discussion covers case studies of community poisoning, toxins regulation, and political debate. Credits: 3.0 Lec-Rec-Lab: (1-2-0) Semesters Offered: Spring: offered alternate years beginning with the 2000–01 academic year Restrictions: May not be enrolled in one of the following Class(es): Freshman Prerequisites: UN 2002

BL 3990 Biological Sciences Teaching Experience Development of teaching skills through assisting in the instruction of a section of biological sciences laboratory. Students gain experience in leadership, group work, organization skills, laboratory preparation, and laboratory instruction. Credits: variable to 4.0; repeatable to a max of 4 Lec-Rec-Lab: (0-0-0) Semesters Offered: Fall Spring Summer Restrictions: Permission of instructor required

BL 4000 Special Problems in Biology A literature and laboratory research problem that culminates in a written report on the work performed. Credits: variable to 9.0; repeatable to a max of 9 Lec-Rec-Lab: (0-0-0) Semesters Offered: On Demand Restrictions: Permission of instructor required

BL 4001 Honors Research in Biology A laboratory-based research problem that culminates in a written report and a seminar presentation on the work performed. Open only to biological sciences and clinical laboratory sciences majors accepted into the Honors in Biological Sciences program. Credits: variable to 9.0; repeatable to a max of 9 LecRec-Lab: (0-0-0) Semesters Offered: On Demand Restrictions: Permission of instructor required; must be enrolled in one of the following Major(s): Biological Sciences Clinical Laboratory Science
BL 4810 Plant Taxonomy The classification system and the criteria for classification employed in the plant kingdom has emphasis on vascular plants. A two-week field course immediately follows spring term. Credits: 4.0 Lec-Rec-Lab: (0-3-3) Semesters Offered: Summer

BL 4820 Biochemical Laboratory Techniques I Laboratory techniques fundamental to studies in the area of biochemistry, including cell growth and disruption, and application of recombinant DNA technology for identification, cloning, and characterization of genes. Credits: 3.0 Lec-Rec-Lab: (1-0-5) Semesters Offered: Fall Restrictions: Must be enrolled in one of the following Class(es): Senior Prerequisites: BL 4010 or permission of instructor

BL 4830 Biochemical Laboratory Techniques II Laboratory techniques basic to biochemistry and molecular biology, including protein assays, purification of natural and recombinant enzymes, enzyme kinetics, and polyclaylmede electrophoresis. Credits: 3.0 Lec-Rec-Lab: (0-1-3) Semesters Offered: Spring Prerequisites: BL 4040

BL 4840 Molecular Biology Techniques Laboratory techniques in molecular biology, including methods of recombinant DNA technology for identification, cloning, and characterization. Credits: 3.0 Lec-Rec-Lab: (0-1-3) Semesters Offered: Spring Restrictions: Must be enrolled in one of the following Class(es): Senior Prerequisites: BL 1020 and BL 2100 and BL 2200 and BL 4030(C)

BL 4860 Toxicology Focuses on principles and testing methods used to describe effects of chemical agents on biological material. Includes carcinogenic, mutagenic, and teratogenic effects and target organs of toxins. Also covers harmful effects of environmental agents such as pesticides and metals on humans, animals, and ecosystems. Credits: 3.0 Lec-Rec-Lab: (2-1-0) Semesters Offered: Fall Restrictions: Must be enrolled in one of the following Class(es): Senior Prerequisites: BL 1020 or BL 1040 or permission of instructor

BL 4979 Clinical Laboratory Administration and Management Discusses clinical laboratory administration and management issues, including method evaluation, reference intervals, quality control, developing standards, operating procedures, and compliance. The laboratory will emphasize techniques for method evaluation, establishing reference intervals, quality control, and compliance with regulatory agencies. Credits: 2.0 Lec-Rec-Lab: (1-0-3) Semesters Offered: Spring Restrictions: Must be enrolled in one of the following Major(s): Clinical Laboratory Science; must be enrolled in one of the following Class(es): Junior Senior Prerequisites: BL 2410 and BL 4550(C) or permission of instructor

BL 4980 Clinical Laboratory Science Core Concept Integration and Application CLS program capstone course. Review, and subsequently learn to integrate and apply, clinical core course material. Assignments include collaborative exercises involving development, peer review, and presentation of worksheets, case studies, and instrument evaluations, as well as other interactive learning activities. Credits: 2.0 Lec-Rec-Lab: (0-2-0) Semesters Offered: Spring Restrictions: Must be enrolled in one of the following Major(s): Clinical Laboratory Science; must be enrolled in one of the following Class(es): Junior Senior Prerequisites: BL 2410 and BL 3230(C) and BL 4550(C) and BL 4640 and BL 4710 or permission of instructor

Civil and Environmental Engineering (CE)

CE 2201 Structural Engineering I The application of statics and mechanics of materials to the analysis of trusses, determinate and indeterminate beams, and small frames. An introduction to the application of dynamics to civil engineering problems. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Fall Spring Prerequisites: MEEM 2120

CE 3101 Civil Engineering Materials Covers properties and behavior of typical civil engineering materials, including wood, metals, aggregates, asphalt cement concrete, Portland cement concrete, and composites. Laboratory exercises demonstrate selected engineering mechanics principles, including elastic, inelastic, and time-dependent material behavior. Additional topics include testing techniques, materials standards, report writing, and presentation of experimental data. Credits: 3.0 Lec-Rec-Lab: (0-2-2) Semesters Offered: Fall Spring Prerequisites: MEEM 2120

CE 3201 Structural Engineering II Introduction to the design of basic civil engineering structural components in steel and reinforced concrete. The Load and Resistance Factor Design method is applied to steel tension, compression, and flexural members, and to basic connections. The Ultimate Strength Design method is applied to concrete flexural members. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Fall Spring Prerequisites: CE 2201

CE 3331 Professional Practice Technical, legal, and ethical considerations in civil engineering practice are illustrated through examination of contract specifications and technical specification writing. Credits: 2.0 Lec-Rec-Lab: (2-0-0) Semesters Offered: Fall Spring Restrictions: Must be enrolled in one of the following Class(es): Junior Senior

CE 3332 Fundamentals of Construction Engineering Introduction to concepts required by professionals involved in the construction industry. Includes contracts, bidding, estimating, scheduling, cash flow, safety, labor issues, equipment ownership, and productivity. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Fall Spring Restrictions: Must be enrolled in one of the following Class(es): Junior Senior

CE 3401 Transportation Engineering Introduction to transportation in the United States, highway types and systems, principles of route location, vehicle characteristics, highway geometric and design standards, drainage, environmental considerations, pavement design, and economic principles and engineering criteria for highway improvements. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Fall Spring Prerequisites: SU 1300

CE 3501 Environmental Engineering Fundamentals Basic principles and calculations for environmental engineering. Covers application of mass balance, energy balance, and physical/chemical/biological principles to water and wastewater treatment; surface water quality, air quality, solid waste management, and groundwater quality. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Fall Prerequisites: MA 2150 and (CH 1100 or CH 1110)

CE 3502 Environmental Monitoring and Measurement Analysis introduction to environmental data acquisition and interpretation, fundamentals of environmental monitoring, instrumentation, measurement techniques, and statistical analysis. Measurements are conducted in a variety of engineered and natural environments. Probability and statistical analyses are applied to the collected data. Credits: 3.0 Lec-Rec-Lab: (0-2-3) Semesters Offered: Spring Prerequisites: MA 2150 and (CH 1100 or CH 1110)

CE 3503 Environmental Engineering Application of fundamental chemical, biological, and physical principles of environmental engineering to design and operation of systems for use for water and wastewater treatment, solid waste management, air pollution control, and analysis of quality of surface air, and groundwater. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Spring Prerequisites: MA 2150 and (CH 1100 or CH 1110)

CE 3504 Fluid Mechanics Basic mechanics of fluids at rest and in motion with emphasis on civil engineering applications. Topics include fluid properties, fluid forces, pipe flow, open channel flow, and flow measurements. Emphasizes incompressible and compressible flows. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Fall Spring Prerequisites: MA 2150 and MEEM 2120

CE 3610 Hydrology Components of the hydrologic cycle and their interactions. Emphasizes rainfall-runoff relationships as applied to civil engineering. Also includes probability concepts. Credits: 3.0 Lec-Rec-Lab: (2-0-2) Semesters Offered: Fall Spring Prerequisites: CE 3600 and (MA 3710 or CE 3502)

CE 3810 Soil Mechanics for Engineers Develops the terminology and descriptions common to the field. Studies soil compressibility, fluid flow, response to mechanical compaction, and strength as well as methods of determining geostatic stresses and stresses changes due to boundary loadings. An experimental laboratory experience reinforces the lecture material. Credits: 4.0 Lec-Rec-Lab: (3-0-3) Semesters Offered: Fall Spring Prerequisites: GE 2000 or GE 2200 and MEEM 2120 and GE 3800 or CE 3600

CE 4201 Matrix Structural Analysis Analysis of trusses and frames by the direct stiffness method. Use of a typical commercial computer code is stressed as a tool for complex structures. Introduces three-dimensional structures. Credits: 3.0 Lec-Rec-Lab: (0-2-2) Semesters Offered: Fall Prerequisites: CE 3201

CE 4221 Structural Steel Design Design of steel frame structures by the Load and Resistance Factor Design method. Covers flexural members including unbraced beams, and plate girders as well as columns under concentrated bending and axial loads, including basic moment magnification techniques. Studies design of selected simple and rigid beam to column connections and introduces composite members. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Spring Prerequisites: CE 4201

CE 4231 Timber and Masonry Design Introduction to timber design and wood as a structural engineering material. Includes beams, slabs, columns, and nailed and bolted connections. Introduction to masonry materials and design. Includes flexural design, plasters, and shear wall design. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Spring Prerequisites: CE 3201

CE 4333 Estimating, Planning and Control of Construction Projects Examination of the different types of estimates and the function of each type. Explores drawing interpretation and quantity take-off techniques leading to the development of an estimate. Shows relationship between contract specification, drawings, project control. The estimate will be illustrated. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Fall Prerequisites: CE 3331 and CE 3332

CE 4401 Pavement Design Analysis, behavior, performance, and structural design of highway pavements. Introduces pavement types and performance concepts, highway traffic and grade characterization, materials employed in highway construction, and highway drainage. Presents common methods used for designing pavement structures as well as mechanistic-empirical approaches. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Fall Prerequisites: CE 3401

CE 4402 Traffic Engineering Introduction to traffic engineering, traffic characteristics, data collection techniques, capacity analysis, traffic control devices, intersection control, traffic signal systems, parking, and street operations. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Fall Restrictions: Must be enrolled in one of the following Class(es): Junior Senior

CE 4501 Environmental Engineering Chemical Processes Application of chemistry, conservation principles, and mathematics to the analysis of chemical processes occurring in natural and engineered environments. Topics include acid-base phenomena, the carbonate system, precipitation and dissolution, chemical equilibria, diffusion, mass transfer, and applications to engineering design. Laboratory experiences illustrate principles and modern measurement techniques. Credits: 4.0 Lec-Rec-Lab: (0-3-3) Semesters Offered: Spring Prerequisites: (CE 3501 or CE 3502) and CE 3562 and CH 3500 or permission of instructor
### Civil Engineering Technology (CE)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CE 4502</td>
<td>Wastewater Treatment and Collection</td>
<td>Principles and design of physical, biological, and chemical processes employed in wastewater treatment and application of basic engineering principles and hydraulics to analysis and design of wastewater collection systems. Unit operations laboratory experience provides hands-on experience related to operation, instrumentation, and design. Credits: 3.0 Lec-Rec-Lab: (0-3-0)</td>
</tr>
<tr>
<td>CE 4503</td>
<td>Drinking Water Treatment and Distribution</td>
<td>Principles and design of physical and chemical processes employed in drinking water treatment and application of basic engineering principles and hydraulics to the analysis and design of water distribution systems. Use computer models to design and operate various unit operations such as aerating, carbon adsorption, and ion exchange. Credits: 3.0 Lec-Rec-Lab: (0-3-0)</td>
</tr>
<tr>
<td>CE 4504</td>
<td>Air Quality Engineering and Science</td>
<td>Overview of air quality regulation in the U.S. and worldwide, including basic concepts of atmospheric chemistry and transport; fugitive, point, and area emissions; principles and trade-offs of operation and design of air pollution control systems; and application of air quality models. Credits: 3.0 Lec-Rec-Lab: (0-3-0)</td>
</tr>
<tr>
<td>CE 4505</td>
<td>Surface Water Quality Engineering</td>
<td>Develops the scientific basis for water quality management in lakes and rivers. Considers the origin, behavior, and fate of nutrients and toxic substances. Introduces engineered approaches for lake management, including mass balance modeling. Presents techniques for water quality restoration and the legal framework supporting pollution control. Credits: 3.0 Lec-Rec-Lab: (0-3-0)</td>
</tr>
<tr>
<td>CE 4506</td>
<td>Application of Environmental Regulations and Pollution Prevention to Engineering</td>
<td>Practice Study of the federal and state regulations (CERCLA, RCRA) and policy that governs management of solid and hazardous waste and how these regulations are incorporated into engineering practice. Other topics include pollution prevention and life cycle analysis, brown field development, baseline environmental assessments, risk assessment, and engineering ethics. Credits: 3.0 Lec-Rec-Lab: (0-3-0)</td>
</tr>
<tr>
<td>CE 4510</td>
<td>Baccalaureate Thesis</td>
<td>Independent baccalaureate research project performed under the supervision of one or more faculty. Credits: 3.0 Lec-Rec-Lab: (0-3-0)</td>
</tr>
<tr>
<td>CE 4620</td>
<td>Open Channel Flow</td>
<td>Analysis of open channel systems, including natural channels, designed channels, flow transitions, nonuniform flow, and unsteady flow. Credits: 3.0 Lec-Rec-Lab: (3-0-0)</td>
</tr>
<tr>
<td>CE 4630</td>
<td>Hydraulic Structures</td>
<td>Analysis and design of water regulating structures. Includes dams, spillways, gates, dikes, levees, stilling basins, culverts, and various minor structures. Credits: 3.0 Lec-Rec-Lab: (3-0-0)</td>
</tr>
<tr>
<td>CE 4820</td>
<td>Geotechnical Engineering</td>
<td>Applies the fundamentals learned in CE3810 to problems in geotechnical engineering. Learn the procedures used to design footings, piled foundations, retaining walls, marine structures, and slopes. Computational laboratory reinforces lectures; students have direct access to the instructor as the design is being developed. Credits: 3.0 Lec-Rec-Lab: (2-0-2)</td>
</tr>
<tr>
<td>CE 4830</td>
<td>Geosynthetics in Engineering Practice</td>
<td>Geosynthetic materials are grouped by mechanical characteristics and engineering use. They are widely used in highway, landfill, and embankment design. Develop designs for filters, soil separators, reinforced earth, and impermeable membranes. Also learn when using a geotextile is appropriate. Credits: 3.0 Lec-Rec-Lab: (3-0-0)</td>
</tr>
<tr>
<td>CE 4900</td>
<td>Engineering Design Project I</td>
<td>An engineering design project related to civil and environmental engineering. Not available to students who have taken CE4905. Students must complete both CE4900 and CE4910 to get credit for either one. Credits: 3.0 Lec-Rec-Lab: (0-2-3)</td>
</tr>
<tr>
<td>CE 4905</td>
<td>Engineering Design Project</td>
<td>An engineering design project related to civil and environmental engineering. Not available to students who have taken CE4900 or CE4910. Credits: 3.0 Lec-Rec-Lab: (0-2-3)</td>
</tr>
<tr>
<td>CE 4910</td>
<td>Engineering Design Project II</td>
<td>Continuation of CE4900. Not available to students who have taken CE4905. Students must complete both CE4900 and CE4910 to get credit for either one. Credits: 3.0 Lec-Rec-Lab: (0-2-3)</td>
</tr>
<tr>
<td>CE 4920</td>
<td>Civil Engineering Independent Study</td>
<td>Approved research or design project in civil engineering, originating with the student or assigned by the instructor. Credits: variable to 3.0; repeatable to a max of 9 Lec-Rec-Lab: (0-0-0)</td>
</tr>
<tr>
<td>CE 4930</td>
<td>Environmental Engineering Independent Study</td>
<td>Approved research or design project in environmental engineering, originating with the student or assigned by the instructor. Credits: variable to 3.0 Lec-Rec-Lab: (0-0-0)</td>
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</tbody>
</table>

### Chemistry (CH)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>CH 0011</td>
<td>Development of Chemistry Skills</td>
<td>Individual appointment or team learning group with an undergraduate student coach to provide chemistry and learning skills development for students enrolled in General or University Chemistry lectures. Credits do not count toward graduation. Credits: 1.0; repeatable to a max of 4; graded Pass/Fail only Lec-Rec-Lab: (0-1-0)</td>
</tr>
<tr>
<td>CH 1000</td>
<td>Preparatory Chemistry</td>
<td>Fundamental principles, laws, and theories of chemistry for students who have not taken high school chemistry, but who have one unit of high school algebra or equivalent. Credit for this course may not be included in the credits required for graduation in the College of Engineering. Credits: 3.0 Lec-Rec-Lab: (0-2-0)</td>
</tr>
<tr>
<td>CH 1080</td>
<td>Topics in General Chemistry</td>
<td>Covers a programmed sequence of topics in general chemistry, including algebra, logs, exponents, and problem-solving strategies. Initial emphasis is on the mathematical skills required to be successful in college chemistry, progressing weekly using chemistry examples. Credits: 1.0; repeatable to a max of 3 Lec-Rec-Lab: (0-1-0)</td>
</tr>
</tbody>
</table>
CH 4631/CM 4631 Polymer Science  Laboratory Students undertake experiments covering aspects of polymer characterisation, processing, and recycling. Also included are experiments in applications such as coatings, adhesives, and composites. Credits: 2.0 Lec-Rec-Lab: (0-1-3) Semesters Offered: Fall Prerequisites: CH 4610(C)

CH 4641/CM 4641 Polymer Chemistry Laboratory Students undertake experiments covering polymer synthesis, identification, and modification. Also includes degradation processes, and formulation of polymer systems. Credits: 2.0 Lec-Rec-Lab: (0-1-3) Semesters Offered: Fall Prerequisites: CH 4620(C)

CH 4710 Chemical Principles in Biology  Studies biochemistry with emphasis on understanding the interconnections between biology and chemistry and the underlying chemical logic of biomolecules and metabolic pathways. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Fall Prerequisites: Spring Prerequisites: CH 2420

CH 4800 Current Topics in Undergraduate Chemistry  Covers chemistry topics not included in regular courses. Topics may include designing organic syntheses, heterogenous catalysis, homogeneous catalysis, solid-state chemistry, and heterocyclic chemistry. Credits: variable to 5.0; repeatable to a max of 12. Lec-Rec-Lab: (0-0-0) Semesters Offered: Fall Spring

CM 4900 Senior Seminar in Chemistry I  Discussion of various topics relevant for professional development. Includes teamwork skills, preparation of abstracts and reports, and scientific ethics. Present results of undergraduate research project or assigned topic in written and oral form. Credits: 1.0 Lec-Rec-Lab: (0-1-0) Semesters Offered: Fall Spring Restrictions: Must be enrolled in one of the following Classes(s): Senior

CM 4910 Senior Seminar in Chemistry II  Continuation of CH4900. All students must complete a comprehensive examination. Credits: 1.0 Lec-Rec-Lab: (0-1-0) Semesters Offered: Spring Prerequisites: Must be enrolled in one of the following Classes(s): Senior

CM 4990 Undergraduate Research in Chemistry  An undergraduate research experience in which students select a literature and laboratory research problem and write a report on the work performed. The student typically signs up for 1 to 3 credits per semester, most problems require more than one semester to complete. Requires GPA of 2.50 or better. Credits: variable to 3.0; repeatable to a max of 12. Lec-Rec-Lab: (0-0-0) Semesters Offered: Fall Spring Summer Restrictions: Permission of department required

Chemical Engineering (CM)

CM 2110 Fund of Chem Engg 1  Application of chemical engineering fundamentals to the design and analysis of chemical processes. Mass balances, energy balances, and fundamentals concepts are applied. Introduces use of Process Flowsheet Simulation Software. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Fall Spring Summer Prerequisites: CH 1110

CM 2120 Fund of Chem Engg 2  Application of mass and energy balances to common chemical engineering operations. Mass balances, energy balances, and fundamental concepts are applied to flow in piping systems, pumps, compressors and stagewise separations (distillation, absorption/desorption, and extraction). Advanced use of Process Flowsheet Simulation software. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Spring Prerequisites: Must be enrolled in one of the following Classes(s): Senior

CM 3110 Transport/Unit Operations 1  Develop an understanding of the processes of momentum transfer (fluid mechanics) and heat transfer. Presents the basic equations of microscopic momentum and heat transfer, along with macroscopic transport equations that can be used in engineering analysis. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Fall Prerequisites: MA 3520 and CM 2110 and PH 2100 or permission of instructor

CM 3115 Measurement Analysis of Data  Introduces basic laboratory methods and experiments in macroscopic material and energy balances, including methods of data analysis, principles of measurement, presentation of experimental data, and design of experiments. Credits: 1.0 Lec-Rec-Lab: (0-0-3) Semesters Offered: Fall Prerequisites: CM 2110 and CM 2120

CM 3120 Transport/Unit Operations 2  Mass transfer fundamentals with applications to chemical processing unit operations. Fundamental topics include Fick's Law, continuity equation with reaction, and mass-transfer coefficients. Applications include absorption, distillation, extraction, adsorption, and membrane separations. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Spring Prerequisites: CM 3110

CM 3210 Classical Thermodynamics  Covers the fundamentals of classical thermodynamics, especially the First and Second Law applied to closed and open systems. Discusses ideal and non-ideal gases along with equations of state. Analyzes energy conversion, especially the First and Second Law applied to closed and open systems. Discusses transfer processes and formulation of systems. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Spring Prerequisites: Must be enrolled in one of the following Classes(s): Junior Senior

CM 3220 Chem Engr Thermodynamics  Application of the first and second laws of thermodynamics to flow processes and to the calculation of thermodynamic properties of homogeneous fluids and phase equilibria. Emphasizes modern computer-oriented methods involving equations of state. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Spring Prerequisites: Must be enrolled in one of the following Classes(s): Junior Senior Prerequisites: CM 2110 and CM 2120 and MA 3520 and CH 3510 and CH 2400

CM 3310 Process Control  Covers methods of analyzing the transient behavior of chemical processing systems. Develops methods of analyzing systems and system components along with the special mathematical techniques needed. These concepts are then applied to illustrate mathematical modeling of large-scale chemical processing systems. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Spring Prerequisites: MA 3520 and PH 2200

CM 3315 Instrumentation Laboratory  Measuring instruments commonly used in chemical industries will be selected in a series of laboratory experiments. Develop methods of data collection and interpretation for performance evaluation. Identify systematic and operating errors to estimate error propagation. Credits: 1.0 Lec-Rec-Lab: (0-0-3) Semesters Offered: Spring Prerequisites: MA 1160 and MA 3520 and PH 2200

CM 3410 Tech Comm for Chem Engg  Study of the purposes, genres, and applications of technical communication in chemical engineering professions, including written, oral, visual, and graphic communication. Assignments may include memos, progress reports, procedures, memos and formal reports, research citations, and job-seeking requirements. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Spring Prerequisites: CM 4110 and CH 4110

CM 3510 Chemical Reaction Engineering  A study of chemical reaction engineering including design and analysis of chemical reactors, the fundamentals of chemical kinetics, and analysis of reaction rate data. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Spring Prerequisites: CM 3220 and MA 3520

CM 3810 Intro to Unit Operations  Quantitative and qualitative design and analysis of the common chemical engineering unit operations: fluid flow (flow in piping systems, pumps, flow measurement, fluidization and thickening); heat transfer (condensers, heat exchangers, and evaporators); and separations processes (distillation, absorption/desorption, and extraction). Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Spring Prerequisites: CH 1110 or CH 1110

CM 4000 Chemical Engineering Research  Student undertakes a problem in some phase of chemical engineering, reviews the literature, obtains experimental data, and submits a report. Credits: variable to 2.0; repeatable to a max of 9 Lec-Rec-Lab: (0-0-0) Semesters Offered: Fall Spring Summer

CM 4110 Unit Operations Laboratory  Provides a rigorous introduction to experiments focused in the unit operations of fluid mechanics, heat transfer, mass transfer, and chemical reaction engineering. Credits: 3.0 Lec-Rec-Lab: (0-1-6) Semesters Offered: Spring Prerequisites: CM 4130(C)

CM 4120 Chemical Plant Operations Lab  A capstone laboratory course focused on chemical manufacturing processes from the perspective of manufacturing excellence. Lecture material includes equality management, the application of statistical process control, and current trends in quality manufacturing. Experimental reinforcement of these concepts occurs in the department’s pilot plants. Credits: 3.0 Lec-Rec-Lab: (0-1-6) Semesters Offered: Spring Prerequisites: CM 4110

CM 4310 Chemical Process Safety/Env  A study of the technical fundamentals of chemical process safety and designing for the environment. Includes toxicology, industrial hygiene, source models, fires and explosions, relief systems, hazard identification, risk assessment, environmental fate and transport, hazardous waste generation, pollution prevention, and regulatory requirements. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Fall Restrictions: Must be enrolled in one of the following Classes(s): Senior Prerequisites: CM 3120 and CM 3220

CM 4610/CH 4610 Introduction to Polymer Science  Introductory study of the properties of polymers. Includes structure and characterization of polymers in the solid state, in solution, and as melts. Topics include viscoelasticity, rubber elasticity, rheology and polymer processing. Applications discussed include coatings, adhesives, and composites. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Spring Prerequisites: CH 1120 or permission of instructor

CM 4620/CH 4620 Polymer Chemistry  Study of polymer chemistry dealing with the mechanisms of polymerization and copolymerization. Study of the chemistry of polymers, including polymer modification and degradation. Topics include methods of measuring and predicting the path of degradation and stabilization. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Fall Prerequisites: CH 2420 or CH 2400 or permission of instructor

CM 4631/CH 4631 Polymer Science Laboratory  Students undertake experiments covering aspects of polymer characterization, processing, and recycling. Also included are experiments in applications such as coatings, adhesives, and composites. Credits: 2.0 Lec-Rec-Lab: (0-1-3) Semesters Offered: Spring Prerequisites: CM 4610(C)

CM 4641/CH 4641 Polymer Chemistry Laboratory  Students undertake experiments covering polymer synthesis, identification, and modification. Also includes degradation processes, and formulation of polymer systems. Credits: 2.0 Lec-Rec-Lab: (0-1-3) Semesters Offered: Fall Prerequisites: CH 4620(C)

CM 4650 Polymer Rheology  A systematic development of the principles and applications of the science of rheology. Reviews vector and tensor mathematics and Newtonian fluid dynamics. Develops the physical and mathematical nature of stress and deformations in materials. Covers the use of theory and application of rheological equations of state. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: On Demand Prerequisites: CM 3110 and MA 3520
CM 4660 Polymer Chemical Engineering Provides an introduction to polymer processes for chemical engineering students. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Fall Restrictions: Must be enrolled in one of the following Classes(s): Senior Prerequisites: CM 3120 and CM 3220

CM 4710 Biochemical Processes Presents an introduction to fundamental and applied aspects of industrial biochemical processing. Topics include cell structure and composition, enzymes and their use in industry, metabolism, bioreactor analysis and design, bioseparations for product recovery, and industrial application. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: On Demand Restrictions: Must be enrolled in one of the following Classes(s): Senior Prerequisites: CM 3120 and CM 3220

CM 4720 Design for Environment Covers fundamental principles of pollution prevention for chemical processes. Topics include hazardous waste generation in the chemical industry, waste and pertinent environmental regulations, risk assessment, environmental impacts of chemical process designs or case studies. Introduces various tools for designing more environmentally friendly chemicals and processes. Credits: 3.0 Lec: (3-0-0) Semesters Offered: On Demand Restrictions: Must be enrolled in one of the following Classes(s): Senior

CM 4730 Subsurface Remediation Covers the scientific and engineering principles of in-situ subsurface remediation. Topics include subsurface fate and transport processes, remediation site characterization, remediation process design, and related policy issues. Credits: 3.0 Lec-Rec-Lab: (2-0-0) Semesters Offered: On Demand Restrictions: Must be enrolled in one of the following Classes(s): Senior

CM 4850 CM Process Analysis Design 1 Technical and economic evaluation of chemical processes and operations. Applies material and energy balances, flow sheets, energy utilization, and optimization to production systems. Requires use of cost estimating and economic evaluation techniques. The optimization project requires a series of memoranda progress reports, a formal final report, and an oral presentation. Credits: 2.0 Lec: (2-0-0) Semesters Offered: Fall Restrictions: Must be enrolled in one of the following Classes(s): Senior

CM 4851 CM Design Laboratory 1 Discuss open-ended problems in chemical engineering design. Credits: 1.0 Lec-Rec-Lab: (0-0-3) Semesters Offered: Fall Restrictions: CM 4850(C)

CM 4860 CM Process Analysis Design 2 Applies technical and economical techniques to the development of a chemical process into an optimized design. Uses process synthesis techniques and market research to develop a conceptual design for a proposed new venture. The AIChE National Design Problem is required of each student as a capstone experience. Credits: 2.0 Lec: (2-0-0) Semesters Offered: Spring Prerequisites: CM 4850

CM 4861 CM Design Laboratory 2 Discusses open-ended problems in chemical engineering design. Credits: 1.0 Lec-Rec-Lab: (0-0-3) Semesters Offered: Spring Prerequisites: CM 4860(C)

CM 4900 Interdisciplinary Design 1 Focuses on an interdisciplinary chemical engineering design project. Credits: 3.0 Lec-Rec-Lab: (0-1-6) Semesters Offered: Fall Restrictions: Must be enrolled in one of the following Classes(s): Senior

CM 4910 Interdisciplinary Design 2 Focuses on an interdisciplinary chemical engineering design project. Credits: 3.0 Lec-Rec-Lab: (0-1-6) Semesters Offered: Spring Restrictions: Must be enrolled in one of the following Classes(s): Senior Prerequisites: CM 4900

CM 4955 Process Control Laboratory Material discussed in CM3310 applied to laboratory experiments to illustrate, by actual practice, the principles of feedback control systems using digital computers. Discusses advanced control concepts: model predictive control and statistical process control. Laboratory experiments involve signal processing, development of a proportional-integral-derivative controller, and tuning of direct digital controllers. Credits: 3.0 Lec-Rec-Lab: (2-0-0) Semesters Offered: On Demand Prerequisites: MA 3250 and CM 3310

CM 4960 Microsystem Engineering Focuses on developing and demonstrating capabilities for fabrication, simulation, and testing of engineering microcomponents. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: On Demand Restrictions: Must be enrolled in one of the following Classes(s): Senior

CM 4990 Current Topics in CM Covers chemical engineering topics not included in regular courses, which may include biochemical engineering, design of biochemical reactions, composite materials, and numerical analysis of transport processes. Credits: variable to 3.0 Lec-Rec-Lab: (0-0-3) Semesters Offered: On Demand

Chemical Engineering Technology (CMT)

CMT 1100 Introduction to Chemical Engineering Technology An overview of the chemical process industries and the role of the chemical engineering technician. Topics include basic unit operations, manufacturing processes, and process safety among others. Guest speakers, field trips, and case studies are included as appropriate. Credits: 4.0 Lec-Rec-Lab: (4-0-0) Semesters Offered: Fall Restrictions: Must be enrolled in one of the following College(s): School of Technology

CMT 1200 Team Skills Development Focuses on team skills development pertaining to the role of the engineering technician. Topics include skills related to the role of a self-directed technical assistant and manufacturing technician in a working environment. Emphasizes communication skills related to personal interaction with others. Credits: 1.0 Lec-Rec-Lab: (1-0-0) Semesters Offered: Fall Restrictions: Must be enrolled in one of the following College(s): School of Technology

CMT 2200 Polymer Chemical Engineering Provides an introduction to polymer processes for chemical engineers. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Fall Restrictions: Must be enrolled in one of the following College(s): School of Technology Prerequisites: MAT 1115 or permission of instructor

CMT 2300 Process Operations I Focuses on basic principles of chemical process unit operations. Discussion of fundamentals of fluid flow, separation processes, and heat transfer. Lecture and laboratory components focus on practical application of process technology, including the operation of pilot-plant-scale equipment. Credits: 5.0 Lec-Rec-Lab: (0-3-3) Semesters Offered: Fall Restrictions: Must be enrolled in one of the following College(s): School of Technology Prerequisites: MAT 1115 or permission of instructor

CMT 2380 Process Operations II Continuation of CMT2200. Focuses on basic principles of chemical process unit operations. Stresses fundamentals of kinetics, separation processes (including distillation), and pilot plant operations. Lecture and laboratory components focus on practical application of process technology, including the operation of MTU’s Process Simulation and Control Center. Credits: 5.0 Lec-Rec-Lab: (0-2-3) Semesters Offered: Spring Restrictions: Must be enrolled in one of the following College(s): School of Technology Prerequisites: MAT 1115 and CMT 2100 or permission of instructor

CMT 2400 Process Safety, Quality and Environmental Issues A discussion of principles of chemical process safety with corresponding laboratory demonstrations. Lectures also focus on quality control, statistical process control, and environmental regulations, impacts and practices, and fire protection related to the chemical industry. Credits: 3.0 Lec-Rec-Lab: (0-2-2) Semesters Offered: Spring Restrictions: Must be enrolled in one of the following College(s): School of Technology Prerequisites: MAT 1115 and CMT 1300 or permission of instructor

CMT 2500 Special Topics in Chemical Engineering Technology Covers key qualitative issues such as ethics, innovation, leadership, labor relations, and management trends. Discussion of current developments that affect the chemical industry, including guest speaker involvements. Laboratory sessions may include special projects related to on-site industrial locations. Credits: 3.0 Lec-Rec-Lab: (0-2-2) Semesters Offered: Spring Restrictions: Must be enrolled in one of the following College(s): School of Technology

CMT 2600 Special Projects in Chemical Engineering Technology Includes work by students on special projects related to chemical engineering technology. Projects may include, among others, equipment installation in a laboratory or industrial setting, or application-focused research projects related to the chemical industry. Requires written documentation of work. Credits: variable to 6.0; repeatable to a max of 12. Lec-Rec-Lab: (0-0-0) Semesters Offered: Fall Restrictions: Must be enrolled in one of the following College(s): School of Technology

Computer Science (CS)

CS 1000 Computer Science Orientation Introduction to computer science as a major field of study. Topics include CS options and specializations, career opportunities, the role of computer science in society. Students are acquainted, through actual use, with University computing facilities. Credits: 1.0; graded Pass/Fail only Lec-Rec-Lab: (0-1-0) Semesters Offered: Fall Restrictions: Must be enrolled in one of the following Major(s): Computer Science

CS 1010 Introduction to Programming for Engineering and Applied Sciences Introduces a widely used, high-level programming language as a problem-solving tool. Topics include the design, coding, debugging, and documentation of programs using good programming style. Emphasizes scientifically oriented problems in the programming assignments. Computer science majors cannot count CS 1111 toward their degree. Credits: 3.0 Lec-Rec-Lab: (0-3-3) Semesters Offered: Fall Spring Restrictions: May not be enrolled in one of the following Major(s): Computer Science Prerequisites: MA 1033 or MA 1033

CS 1020 Principles of Computer Science Topics include an accurate model of how a computer works, the role of computers in society, and computer science methodology. Students learn to program, appreciate the difficulties in building complex software systems, develop algorithmic problem-solving skills, and create a significant piece of software while making use of existing software. Credits: 3.0 Lec-Rec-Lab: (0-2-2) Semesters Offered: Spring

CS 1030 Introduction to Engineering and Scientific Computing Introduces the basic principles of computer science, and one of the following options for scientific and engineering problems, and fundamental programming constructs. All concepts are motivated by real-life applications. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Fall Spring Prerequisites: MA 2150(C) or MA 2160(C)

CS 1090 Special Topics in Computer Science Special topics in computer science offered on occasion based on student and faculty demand and interest. Credits: variable to 3.0 May be repeated Lec-Rec-Lab: (0-0-0) Semesters Offered: Fall Spring Summer Restrictions: Permission of instructor required
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CS 1121</td>
<td>Introduction to Computer Science I</td>
<td>Starting point of the computer science program. A high-level, object-oriented programming language is introduced as a problem-solving tool. Topics include design, coding, documentation, debugging, and testing of programs. Programming assignments are given in both a closed lab setting and as homework. Credits: 3.0 Lec-Rec-Lab (0-2-1) Semester Offered: Fall Spring Prerequisites: MA 1032 or MA 1033 or permission of instructor</td>
</tr>
<tr>
<td>CS 1122</td>
<td>Introduction to Computer Science II</td>
<td>Continuation of CS 1121. Topics include object-oriented design, defining and using classes, complexity-based algorithm choices, data abstraction, simple data structures, pointers, recursion, and software development concepts. Homework programming assignments are given. Credits: 3.0 Lec-Rec-Lab (0-3-0) Semester Offered: Fall Spring Prerequisites: CS 1121 or permission of instructor</td>
</tr>
<tr>
<td>CS 1131</td>
<td>Computer Science I</td>
<td>An alternative starting point of the computer science program for students with some programming experience, combining material from CS1121 and CS1122, offered at an accelerated pace. Homework programming assignments are given. Credits: 4.0 Lec-Rec-Lab (0-4-0) Semester Offered: Fall Spring Prerequisites: MA 1032 or MA 1033 or permission of instructor</td>
</tr>
<tr>
<td>CS 1132</td>
<td>Computer Science II</td>
<td>A continuation of CS 1131. Contains material from CS1121, CS 1122, and CS2321, offered at an accelerated pace. Additional topics include discrete structures (propositional calculus, boolean algebra, sets, relations, functions, recurrence relations, and combinatorics), additional data structures (ADTs, trees, tables), and software development techniques. Credits: 4.0 Lec-Rec-Lab (0-3-3) Semester Offered: Fall Spring Prerequisites: CS 1131</td>
</tr>
<tr>
<td>CS 2090</td>
<td>Special Topics in Computer Science I</td>
<td>Special topics in computer science offered on occasion based on student and faculty demand and interest. Credits: variable to 3.0 May be repeated Lec-Rec-Lab (0-0-0) Semester Offered: Fall Spring Summer Restrictions: Permission of instructor required</td>
</tr>
<tr>
<td>CS 2141</td>
<td>C++ as a Second Language</td>
<td>Designed for programmers wishing an accelerated introduction to C++. Topics include a comparison of features of C++ and Java, pointers, virtual functions, dynamic binding, operator overloading, C++ and C, VO, structures, prototypes, parameter passage, variables, scope, lifetime, pointers, dynamic arrays, and object-oriented programming. Credits: 2.0 Lec-Rec-Lab (0-2-0) Semester Offered: Spring Prerequisites: CS 1122 or CS 1132 or permission of instructor</td>
</tr>
<tr>
<td>CS 2221</td>
<td>Foundations I</td>
<td>Presents a unifying foundation of important topics in computer science, including discrete structures (propositional calculus, boolean algebra, sets, relations, functions, recurrence relations, combinatorics, and mathematical induction), additional data structures (ADTs, trees, tables), and programming projects designed to apply these concepts. Credits: 3.0 Lec-Rec-Lab (0-3-0) Semester Offered: Fall Spring Prerequisites: CS 1122 or CS 2321 or permission of instructor</td>
</tr>
<tr>
<td>CS 2222</td>
<td>Foundations II</td>
<td>A continuation of CS221. A unifying presentation of important topics in discrete structures (predicate calculus, graphs, recursion, inductive proofs), additional data structures (graphs, queues, lists), formal languages (regular expressions and grammars), abstract machines (finite state machines, Turing machines, and others), and programming projects designed to apply these concepts. Credits: 3.0 Lec-Rec-Lab (0-3-0) Semester Offered: Fall Spring Prerequisites: CS 1132 or CS 2321 or permission of instructor</td>
</tr>
<tr>
<td>CS 2911</td>
<td>Introduction to Numerical Methods with Fortran</td>
<td>Topics include floating point arithmetic, sources of numerical error, Taylor polynomials, solution of linear systems and nonlinear equations, interpolation, numerical integration, and numerical solution of differential equations. ForTRAN 90 topics include data types, control-flow, arrays, procedures, pointers and dynamic data structures, I/O, and modules. Numerical algorithms will be coded. Credits: 3.0 Lec-Rec-Lab (0-3-0) Semester Offered: Spring Prerequisites: (CS 1010 or CS 2122 or CS 3122) and MA 1150 or MA 1160 or permission of instructor</td>
</tr>
<tr>
<td>CS 3090</td>
<td>Special Topics in Computer Science II</td>
<td>Special topics in computer science offered on occasion based on student and faculty demand and interest. Credits: variable to 3.0 May be repeated Lec-Rec-Lab (0-0-0) Semester Offered: Fall Spring Summer Restrictions: Permission of instructor required</td>
</tr>
<tr>
<td>CS 3141</td>
<td>System Software Project</td>
<td>Introduction to the development of large software projects. Presents examples of software design, quality assurance techniques, and test-case design in conjunction with a significant team project involving design, test, and code documentation as well as user documentation. Other topics include teamwork, user interfaces, social and professional responsibilities. Credits: 3.0 Lec-Rec-Lab (0-3-0) Semester Offered: Fall Spring Prerequisites: CS 2322</td>
</tr>
<tr>
<td>CS 3421</td>
<td>Computer Architecture</td>
<td>Introduction to the logical structure of computers, including the fundamentals of logic design, information storage and manipulation, control, input/output, and assembly language programming. Topics include a review of current hardware technology, combinational and sequential logic, arithmetic, datapaths, hard-wired control, interrupts, caches, virtual memory, and an introduction to pipelining. Credits: 4.0 Lec-Rec-Lab (0-4-0) Semester Offered: Fall Spring Prerequisites: CS 3221 or permission of instructor</td>
</tr>
<tr>
<td>CS 3611</td>
<td>Graphical User Interface Design</td>
<td>Principles of the design and implementation of graphical user interfaces. Topics include relation between GUIs and the operating system, hierarchical structure of tools for GUI construction, and human factors in GUI design. Students receive direct experience with the creation of GUIs and are introduced to basic issues of human-machine interaction. Credits: 3.0 Lec-Rec-Lab (0-3-0) Semester Offered: On Demand Prerequisites: CS 2321 or CS 1132</td>
</tr>
<tr>
<td>CS 3621</td>
<td>Introduction to Computing with Geometry</td>
<td>Topics include the creation, representation and manipulation of geometric objects. Surveys major paradigms of building shapes, including polyhedra, curved solids, curves, and surfaces. Covers classical computational geometry topics such as convex hulls and tessellations, algorithm robustness, and the impact of finite precision arithmetic on geometric computing. Applications discussed. Credits: 3.0 Lec-Rec-Lab (0-3-0) Semester Offered: Fall Prerequisites: MA 2160 and MA 2330 and CS 1122 and CS 2141 or permission of instructor</td>
</tr>
<tr>
<td>CS 4000</td>
<td>Senior Seminar</td>
<td>Topics include ethical models, legal issues, privacy and security, social responsibility, professional responsibility and service, and the future of computing. Students will complete the ETS MFT assessment exam. Credits: 3.0 Lec-Rec-Lab (0-3-0) Semester Offered: Fall Spring Restrictions: Must be enrolled in one of the following Class(es) Senior Prerequisites: CS 3141</td>
</tr>
<tr>
<td>CS 4090</td>
<td>Special Topics in Computer Science II</td>
<td>Special topics in computer science offered on occasion based on student and faculty demand and interest. Credits: variable to 4.0 May be repeated Lec-Rec-Lab (0-0-0) Semester Offered: Fall Spring Summer Restrictions: Permission of instructor required</td>
</tr>
<tr>
<td>CS 4099</td>
<td>Directed Study in Computer Science</td>
<td>Students study one or more special topics in computer science under the direction of one or more faculty members. Credits: variable to 4.0; repeatable to a max of Lec-Rec-Lab (0-0-0) Semester Offered: Fall Spring Restrictions: Permission of instructor required</td>
</tr>
<tr>
<td>CS 4211</td>
<td>Programming Languages</td>
<td>A discussion of the concepts underlying programming languages. Topics include programming paradigms; language criteria (including syntax, semantics, run-time behavior, and implementation issues); data, procedure, functional, and control abstraction; functional programming; and logic programming. Credits: 3.0 Lec-Rec-Lab (0-3-0) Semester Offered: Fall Spring Prerequisites: CS 2322 or permission of instructor</td>
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<tr>
<td>CS 4311</td>
<td>Compiler Construction</td>
<td>Introduction to compilation techniques, including parsing, syntax-directed translation, code generation and optimization. Requires a significant project. Credits: 4.0 Lec-Rec-Lab (0-3-1) Semester Offered: Fall Spring Prerequisites: CS 3141 and CS 4121 or permission of instructor</td>
</tr>
<tr>
<td>CS 4312</td>
<td>Introduction to Computation Theory</td>
<td>Covers languages, automata, and grammars in some depth. Topics include deterministic and non-deterministic machines, push-down automata, Turing machines, the halting problem, the Chomsky hierarchy of languages, closure properties for language classes, and undecidable problems. Credits: 3.0 Lec-Rec-Lab (0-3-0) Semester Offered: Fall Prerequisites: CS 2322 or permission of instructor</td>
</tr>
<tr>
<td>CS 4321</td>
<td>Introduction to Algorithms</td>
<td>Techniques for design and analysis of computer algorithms. Topics include asymptotic notation, methods for solving recurrences, divide-and-conquer algorithms, dynamic programming, greedy algorithms, graph algorithms, and NP-completeness. Credits: 3.0 Lec-Rec-Lab (0-3-0) Semester Offered: Fall Spring Prerequisites: CS 2322</td>
</tr>
<tr>
<td>CS 4411</td>
<td>Introduction to Operating Systems</td>
<td>Presents topics on program representation and execution, operating systems, process and threads, process scheduling, memory management, file systems, network programming, and security and privacy. Credits: 4.0 Lec-Rec-Lab (0-4-0) Semester Offered: Fall Spring Prerequisites: CS 2322 or CS 3421 or permission of instructor</td>
</tr>
<tr>
<td>CS 4421</td>
<td>Database Systems</td>
<td>Topics include goals of database management; data definition; data models; data normalization; data retrieval and manipulation; security, integrity, and privacy measures; file, data, and storage organization; object-database systems; and parallel and distributed databases. Surveys a number of general database systems and examines in detail at least one database system. Credits: 3.0 Lec-Rec-Lab (0-3-0) Semester Offered: Spring Prerequisites: CS 4411 and CS 2141 or permission of instructor</td>
</tr>
<tr>
<td>CS 4431</td>
<td>Advanced Computer Architecture</td>
<td>Architecture of high-performance parallel computer systems. Introduces various forms of parallelism, such as multiple functional units, pipelining, multithreaded, and massively parallel arrays. Also covers interlaved memory, caching, and interconnection networks. Includes analytic and simulation models of architectural features that implement or support parallel processing. Credits: 4.0 Lec-Rec-Lab (0-3-3) Semester Offered: Fall Spring Prerequisites: (CS 3421 and CS 4411) or (EE 2170 and EE 3170 and CS 4411) or permission of instructor</td>
</tr>
<tr>
<td>CS 4441</td>
<td>Operating Systems</td>
<td>Continuation of CS4411. Topics include file systems, I/O, distributed systems, security, and symmetric multiprocessing. Requires a significant programming project. Credits: 3.0 Lec-Rec-Lab (0-3-0) Semester Offered: Spring Prerequisites: CS 3141 and CS 4411 or permission of instructor</td>
</tr>
<tr>
<td>CS 4451</td>
<td>Systems Administration</td>
<td>Introduction to fundamental systems-administration concepts. Topics include an introduction to systems administration process model as well as the building blocks for the process model. Emphasizes technical issues, but economic affects will also be addressed. Credits: 4.0 Lec-Rec-Lab (0-3-3) Semester Offered: Fall Spring Prerequisites: CS 4441 or permission of instructor</td>
</tr>
<tr>
<td>CS 4461</td>
<td>Computer Networks</td>
<td>Computer network architectures and protocols; design and implementation of datalink, network, and transport layer functions. Introduction to the Internet protocol suite and to network tools and programming. Credits: 3.0 Lec-Rec-Lab (0-3-0) Semester Offered: Spring Prerequisites: CS 4521 and CS 4441</td>
</tr>
</tbody>
</table>
CS 4611 Artificial Intelligence
Fundamental ideas and techniques that are used in the construction of AI problem solvers. Topics include knowledge representation, problem solving, heuristics, search heuristics, inference mechanisms, expert systems, and language understanding. Credits: 3.0 Lec-Rec-Lab: (0-3-3) Semesters Offered: Spring Prerequisites: CS 4121 or permission of instructor

Economics (EC)

EC 2000 Principles of Economics
An introduction to economics. The microeconomics portion covers consumer choice, the firm, value and price theory and distribution theory. The macroeconomics portion covers national income analysis, fiscal policy, money and monetary policy, the commercial banking system, and the Federal Reserve System. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Fall Spring Summer Prerequisites: UN 2002

EC 3000 Microeconomic Theory
Analysis of rational choices by consumers and producers and how these choices affect the allocation of resources and the distribution of income in a market economy. Topics include strategic interaction, uncertainty, prices, and market structure. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Spring Summer Prerequisites: EC 2000 and (MA 1135 or MA 1150 or MA 1160 or MAT 1125) and UN 2002

EC 3010 Macroeconomic Theory
Analysis of the determinants of the level of output, employment, prices, and economic growth with an emphasis on fiscal policy and monetary policy. Credits: 3.0 Lec-Rec-Lab: (3-0-3) Semesters Offered: Fall Summer Prerequisites: EC 2000 and (MA 1135 or MA 1150 or MA 1160 or MAT 1125) and UN 2002

EC 3020 History of Economic Thought
Development of economic ideas from the mercantilists and physiocrats through modern supply side economics, including economists such as Smith, Ricardo, Marx, Keynes, Mill, and Friedman. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Fall; offered alternate years beginning with the 2000-01 academic year Prerequisites: EC 2000 and (UN 1002 or UN 1003)

EC 3030 Game Theory/Strategic Behavior
The study of strategic situations involving the interactions of individuals. Modeling techniques are applied to game situations faced in business, entertainment, politics, and the daily routine of life. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Spring; offered alternate years beginning with the 2000-01 academic year Prerequisites: EC 2000 and (UN 1002 or UN 1003)

EC 3100 International Economics
Introduction to international economics, including balance of payments, accounting, foreign exchange markets, international trade theory, barriers to trade, trade and development, regional economic integration, and current U.S. international economic issues. Credits: 3.0 Lec-Rec-Lab: (3-0-3) Semesters Offered: Fall Spring Summer Prerequisites: EC 2000 and UN 2002

EC 3300 Industrial Organization
Economic analysis of market power and industry structure. Topics include the goals of public policy toward business, antitrust policy, economic regulation, public enterprise, and social regulation of health, safety, and the environment. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Spring Summer Prerequisites: EC 2000 and UN 2002

EC 3400 Economic Decision Analysis
For students who wish to take 3 credits of economic decision analysis in one semester rather than one or two of the individual modules. EC3401 is the first five weeks of the course; EC3402 is the second five weeks; and EC3403 is the third five weeks. See EC3401-3 for contents. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Fall Spring Restrictions: Must be enrolled in one of the following Classes: J. Junior Senior Prerequisites: UN 2002

EC 3401/ENG 3403 Economic Decision Analysis I
For students who want to take EC3400 in modules. Covers techniques for effective decision making related to the time value of money. Covers interest rate calculations, loan repayments, and basic decision tools for comparing alternatives (present and annual worth, rate-of-return, etc.). Taught in the first five weeks of EC3400. Credits: 1.0 Lec-Rec-Lab: (3-0-3) Semesters Offered: Fall Spring Restrictions: Must be enrolled in one of the following Classes: J. Junior Senior Prerequisites: EC 2401 and UN 2002

EC 3402/ENG 3404 Economic Decision Analysis II
For students who want to take EC3400 in modules. Deepens coverage of principles and techniques for making effective decisions by introducing sources of funding and cost of capital, benefit and cost estimation, depreciation and taxation, and project evaluation. Taught during the second five weeks of EC3400. Credits: 1.0 Lec-Rec-Lab: (3-0-3) Semesters Offered: Fall Spring Restrictions: Must be enrolled in one of the following Classes: J. Junior Senior Prerequisites: EC 2401 and UN 2002

EC 3403/ENG 3403 Economic Decision Analysis III
For students who want to take EC 3400 in modules. Provides an understanding of the setting in which effective decisions are made: covers business organization, financial statements, inflation, risk and uncertainty, project and business financing, and capital budgeting. Taught during the third five weeks of EC 3400. Credits: 1.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Fall Spring Restrictions: Must be enrolled in one of the following Classes: J. Junior Senior Prerequisites: EC 3402 and UN 2002

Public Economics
Economic analysis of how democratic governments generate revenue (primarily taxation) and make expenditure decisions and how such decisions impact the welfare of individuals. Topics include market failures, voting processes, income redistribution programs, efficiency and incidence of taxation. Credits: 3.0 Lec-Rec-Lab: (3-0-3) Semesters Offered: Spring; offered alternate years beginning with the 2001-02 academic year Prerequisites: EC 2000 and UN 2002

EC 3700 Labor/Human Resource Economics
Economic analysis of labor markets and human resources. Topics include the supply and demand for labor, labor market structure, economic theories, human capital theory, and factors affecting labor supply and training, causes of wage differentials, and economic effects of discrimination. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Fall; offered alternate years beginning with the 2001-02 academic year Prerequisites: EC 2000 and (BA 2100 or MA 2710 or MA 3710) and UN 2002

EC 4000 Senior Seminar in Economics
A senior capstone seminar in which students discuss and conduct research under the guidance of several faculty members. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Spring Restrictions: Must be enrolled in one of the following Major(s): Economics; must be enrolled in one of the following Class(es): Senior

EC 4200 Econometrics
Introduces techniques and procedures to estimate and test economic and financial relationships developed in business, economics, social and physical sciences. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Fall Prerequisites: EC 2000 and (BA 2100 or MA 2710) and (MA 1135 or MA 1125) or permission of instructor

EC 4400 Banking and Financial Institutions
Analysis of asset and liability management of financial institutions and the role of financial institutions in the U.S. and international economy. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Spring Prerequisites: (EC 3103 or BA 3400) and UN 2002

EC 4600 Natural Resource and Environmental Economics
Examines economic and policy issues related to the supply and use of natural resources and to the environmental problems related to their use. Resources studied include minerals, energy, agriculture, forests, fisheries, wildlife, and water. Policy issues include efficiency, benefit cost analysis, U.S. environmental policy, and international concerns. Credits: 3.0 Lec-Rec-Lab: (3-0-3) Semesters Offered: Spring Prerequisites: EC 2000 and UN 2002

EC 4610/MG 4610 Mineral Industry Economics
Studies the role of minerals and metals in society and the economics of their use. Applies economic principles to examine the supply, demand, markets, and foreign trade for important minerals and metals. Examines the effect of government policies on the minerals industries. Requires a technical report. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Fall Prerequisites: EC 2000 and UN 2002 or permission of instructor

EC 4620 Energy Economics
Introduction to the institutional, technical, and economic issues of the production and use of energy resources, including petroleum, natural gas, coal, nuclear, electric utilities, and alternative energy sources. Applies economic analysis to industrial and policy problems of the supply, distribution, and use of energy resources, including environmental and social consequences. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Spring Prerequisites: EC 2000 and UN 2002

EC 4700 Economics of Health Care
Economic analysis of the health care sector: organization, demand and supply factors, pricing practices, financing mechanism, public vs. private, impact on third party, medical school funding and admission policy, insurance and prepayment, and health and economic development. Credits: 3.0 Lec-Rec-Lab: (3-0-3) Semesters Offered: Fall Prerequisites: EC 2000 and UN 2002 or permission of instructor

EC 4800 Economics of Technological Change
Economic issues related to technological change: role of technological change in economic growth, economics of research and development, processes of invention and innovation and their relation to market structure, diffusion of new technology and its impact on markets, economic aspects of intellectual property, and public policy toward technological change. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Fall Prerequisites: EC 2000 and UN 2002

Research
Under the general guidance of a faculty member, students read, conduct research, and prepare reports and papers as required. Credits: variable to 4.0; repeatable to a max of 6. Lec-Rec-Lab: (0-0-3) Semesters Offered: On Demand Prerequisites: EC 2000 or permission of instructor

Special Topics in Economics
Economic topics of interest to students and faculty. Credits: variable to 4.0; repeatable to a max of 6. Lec-Rec-Lab: (0-0-3) Semesters Offered: On Demand Prerequisites: EC 2000 or permission of instructor

Education (ED)

ED 2010 Field Study in Education
Elementary School Observations in an elementary school, offering relevant school experience to help clarify career goals. Either ED2010 or ED2020 is required for admission to the teacher education certification sequence. Students with documented experience working with children may petition the department to waive this requirement. Credits: 1.0 Lec-Rec-Lab: (0-0-3) Semesters Offered: Fall Spring Restrictions: Permission of department required
ED 2020 Field Study in Education: Secondary School Observations in a secondary school, offering relevant school experience to help clarify career goals. Either ED2020 or ED2100 is required for admission to the teacher education certification sequence. Students with documented experience with children may petition the department to waive this requirement. Credits: 3.0 Lec-Rec-Lab: (0-0-3) Semesters Offered: Fall
Spring Restrictions: Permission of department required
ED 2100 Instructional Technology Provides the development of knowledge and skills required to use information and communication technologies as instructional tools. Use of instructional technology will be considered within a context of relevant research and theory pertaining to human learning. Examines various technologies used to produce, present, and distribute instruction. Credits: 2.0 Lec-Rec-Lab: (2-0-0) Semesters Offered: Fall Spring Restrictions: Permission of department required
ED 3110 Psychological Foundations of Learning How human beings grow and learn with major emphasis on the early adolescent, the adolescent, the learning disabled, and culturally diverse classrooms. Psychological bases of educational procedures and practices are established, with special reference to the exceptional child. Credits: 2.0 Lec-Rec-Lab: (2-0-0) Semesters Offered: Fall Spring Summer Corequisites: ED 3210, ED 3310 Prerequisites: PSY 2000 and (UN 1002 or UN 1003)
ED 3210 Foundations of Education Contemporary issues in education from historical, philosophical, sociological, and legal perspectives. Emphasizes the structure/function of U.S. education as well as exceptional children, especially the handicapped and culturally different. This course is one component of the Teacher Education Early Block. Requires admission to teacher education program. Credits: 2.0 Lec-Rec-Lab: (0-0-3) Semesters Offered: Fall Spring Restrictions: Must be enrolled in one of the following Classes): Junior Corequisites: ED 3110, ED 3110, ED 3310
ED 3310 Seminar in Education Introduces contemporary issues in teacher education. Synthesis of clinical experiences with the psychological foundation of learning and foundations of education courses. This course is one component of the Teacher Education Early Block. Requires admission to teacher education program. Credits: 1.0 Lec-Rec-Lab: (0-1-0) Semesters Offered: Fall Spring Restrictions: Must be enrolled in one of the following Class(es): Junior Corequisites: ED 3110, ED 3110
ED 3410 Clinical Experience Observation, tutoring, and classroom teaching in an area elementary school classroom. This course is one component of the Teacher Education Early Block. Requires admission to teacher education program. Credits: 1.0 Lec-Rec-Lab: (0-0-3) Semesters Offered: Fall Spring Restrictions: Must be enrolled in one of the following Class(es): Junior Corequisites: ED 3110, ED 3110
ED 3510 Communicating Science I Students will make presentations in local K-8 classrooms and/or at evening family science nights conducted at area schools. Classroom lectures will highlight the rationale for interacting with schools and communities as a professional, presentation skills, effective teaching techniques, learning styles, classroom management techniques, and model hands-on learning techniques. Credits: 2.0 Lec-Rec-Lab: (0-0-2) Semesters Offered: Fall Spring
ED 3511 Communicating Science II Students will make presentations in local K-8 classrooms and/or at evening family science nights conducted at area schools. Classroom lectures will highlight the rationale for interacting with schools and communities as a professional, presentation skills, effective teaching techniques, learning styles, classroom management techniques, and model hands-on learning techniques. Credits: 1.0 Lec-Rec-Lab: (0-0-1) Semesters Offered: Fall Spring
ED 4500 Special Problems In Education Literature, laboratory, or field investigation under the supervision of authorized University faculty/staff with a required report of work performed and results obtained. Credits: variable to 6.0; repeatable to a max of 9 Lec-Rec-Lab: (0-0-0) Semesters Offered: Fall Spring
ED 4510 Special Topics in Education Students identify and develop an in-depth examination of current topics in education for further research and study. Working in consultation and agreement with select faculty, students engage in active inquiry on leading educational issues. Credits: variable to 6.0; repeatable to a max of 9 Lec-Rec-Lab: (0-0-0) Semesters Offered: On Demand
ED 4600 Independent Study in Education Through independent study, gain additional insights to relevant topics in education and research. Students must work directly with select faculty to develop a structured line of study on select educational topics. Credits: variable to 6.0; repeatable to a max of 9 Lec-Rec-Lab: (0-0-0) Semesters Offered: On Demand Restrictions: Permission of instructor required
ED 4810 Methods of Teaching Science, Math, and Computer Science Application of learning and instructional theories to the teaching of science, mathematics, and computer science. Emphasizes methods and materials used to teach early adolescents and adolescents. Taught from the perspective of science/mathematics/computer science teachers. Lab offers opportunities to refine instructional techniques. Credits: 4.0 Lec-Rec-Lab: (0-3-3) Semesters Offered: Fall Spring Restrictions: Permission of department required; must be enrolled in one of the following Class(es): Senior Corequisites: ED 4910 Corequisites: ED 3110 and ED 3210 and ED 3310 and ED 3410
ED 4820 Methods of Teaching Social Studies Application of learning and instructional theories to the teaching of social studies and English. Emphasizes methods and materials used to teach early adolescents and adolescents. Taught from the perspective of social studies teachers. Lab offers opportunities to refine instructional techniques. Credits: 4.0 Lec-Rec-Lab: (0-3-3) Semesters Offered: Fall Spring Restrictions: Permission of department required; must be enrolled in one of the following Class(es): Senior Corequisites: ED 4910 Corequisites: ED 3110 and ED 3210 and ED 3310 and ED 3410
ED 4910 Directed Teaching Knowledge of human growth and learning theories, methods and materials, and individual differences applied to classroom settings conducted under the supervision of an experienced middle or secondary school teacher. Requires admission to teacher education program. Credits: 12.0 Lec-Rec-Lab: (0-0-36) Semesters Offered: Fall Spring Restrictions: Permission of department required; must be enrolled in one of the following Class(es): Senior Corequisites: ED 3110 and ED 3210 and ED 3310 and ED 3410 and HU 4150 and (ED 4810(C) or ED 4820(C))

Electrical Engineering (EE)

EE 1800 Special Topics in Electrical Engineering Covers specific topics in electrical engineering. Credits: variable to 4.0; repeatable to a max of 6 LeC-Rec-Lab: (0-0-0) Semesters Offered: On Demand Restrictions: Permission of instructor and department required
EE 1870 Special Topics in Computer Engineering Covers special topics in computer engineering. Credits: variable to 4.0; repeatable to a max of 6 LeC-Rec-Lab: (0-0-0) Semesters Offered: On Demand Restrictions: Permission of instructor and department required
EE 2110 Electric Circuits Introduction to linear circuit analysis, circuit elements, network theorems, steady-state sinusoidal response, transient response using Laplace transforms, and frequency response. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Fall Spring Restrictions: EE 2150 and EE 2160(C) and MA 3520 and PH 2200(C)
EE 2130 Introduction to Signal Processing Introduces the mathematical modeling techniques used in the design and analysis of analog and digital signal-processing systems. Topics include analog and digital signal processing, spectral representations, filtering, frequency response, and the Fourier and Z-transforms. Applications include communication, control, audio, video, and image processing systems. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Fall Spring Restrictions: MA 2160 and (CS 1121 or CS 1131)
EE 2160 Linear Systems Analysis Introduces the mathematical analysis of signals and systems. Topics include differential equations, state models, Laplace transforms, frequency response, Fourier series, Fourier transforms, discrete Fourier transforms, and the analysis of discrete-time systems with Z-transforms. Applications include signal processing, communications, and feedback control. Computation (using MATLAB) is integrated throughout the course. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: On Demand Restrictions: EE 2150 and MA 2320 and MA 3520
EE 2170 Digital Systems Introduces the analysis, design, and application of digital systems. Includes Boolean algebra, logic gates, combinational and sequential logic, storage elements, and VHDL-based logic synthesis. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Fall Spring Restrictions: CS 1121 or CS 1131
EE 2301 EE Lab 1 First laboratory course in electrical engineering. Covers aspects of digital systems and digital signal processing. Credits: 1.0 Lec-Rec-Lab: (0-0-2) Semesters Offered: Fall Spring Restrictions: EE 2150(C) and EE 2160(C)
EE 2302 EE Lab 2 Second laboratory course in electrical engineering. Investigates electric circuits and linear systems. Credits: 1.0 Lec-Rec-Lab: (0-0-2) Semesters Offered: Fall Spring Restrictions: EE 2110(C) and EE 2160(C)
EE 2800 Special Topics in Electrical Engineering Covers specific topics in electrical engineering. Credits: variable to 4.0; repeatable to a max of 6 LeC-Rec-Lab: (0-0-0) Semesters Offered: On Demand Restrictions: Permission of instructor and department required
EE 2870 Special Topics in Computer Engineering Covers special topics in computer engineering. Credits: variable to 3.0; repeatable to a max of 6 LeC-Rec-Lab: (0-0-0) Semesters Offered: On Demand Restrictions: Permission of instructor and department required; may not be enrolled in one of the following Class(es): Senior
EE 3010 Circuits and Instrumentation Designed for nonmajors. Covers the principles of electrical and electronic measurements, including dc, ac, semiconductor devices, amplifiers, and filtering. Credits: 3.0 Lec-Rec-Lab: (2-0-2) Semesters Offered: Fall Spring Summer Restrictions: May not be enrolled in one of the following Major(s): Electrical Engineering
EE 3120 Electric Energy Systems An overview of the generation and utilization of electrical energy. Covers three-phase circuits, transformers, photovoltaics, batteries, electromechanical energy conversion, and an overview of electric power systems, including economic issues. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Fall Spring Restrictions: EE 2110
EE 3130 Electronics Covers the fundamentals of electronic circuits and devices. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Fall Spring Restrictions: EE 2110
EE 3140 Electromagnetics Covers basic principles of engineering electromagnetics with an emphasis on Maxwell's equations. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Fall Spring Restrictions: PH 2200 and MA 3160
EE 3150 Communications Science Introduces the mathematical theory of communication science. Topics include baseband pulse and digital signaling, bandpass signaling, AM and FM systems, bandpass digital systems, and case studies of communication systems. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Fall Spring Restrictions: EE 2160 and MA 3720
Microprocessors: Introduces the analysis, design, and application of microprocessor-based digital systems. Topics include microprocessor architecture, instruction sets, pipelining concepts, software design, and input/output principles. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Fall Summer Prerequisites: EE 2170

Introduction to Motor Drives Provides a thorough understanding of how electric motor drives can be used to control speed and position in various applications. Course is equally useful for nonmajors. Credits: 4.0 Lec-Rec-Lab: (0-3-2) Semesters Offered: Fall Spring Prerequisites: EE 2110 or EE 3010

EE 3301 EE Lab 3 Third laboratory course in electrical engineering. Covers the practical aspects of microprocessors and energy systems. Credits: 1.0 Lec-Rec-Lab: (0-0-2) Semesters Offered: Fall Spring Prerequisites: EE 3170(C) and EE 3120(C)

EE 3302 EE Lab 4 Fourth laboratory course in electrical engineering. Covers electronics and its applications to communications. Credits: 1.0 Lec-Rec-Lab: (0-0-2) Semesters Offered: Fall Spring Prerequisites: EE 3130(C) and EE 3150(C)

EE 3303 EE Lab 5 Fifth laboratory course in electrical engineering. Covers microprocessors and electronics. Credits: 1.0 Lec-Rec-Lab: (0-0-2) Semesters Offered: Fall Spring Prerequisites: EE 3130(C) and EE 3150(C)

Special Topics in Electrical Engineering Covers special topics in electrical engineering. Credits: variable to 4.0; repeatable to a max of 6.0Grading Pass/Fail only Lec-Rec-Lab: (0-0-0) Semesters Offered: On Demand Restrictions: Permission of instructor and department required

Electrical Engineering Project A project in electrical engineering. An individual student or a group of students complete a mutually-agreed-upon project in consultation with a faculty member. Credits: variable to 3.0; repeatable to a max of 6Grading Pass/Fail only Lec-Rec-Lab: (0-0-0) Semesters Offered: On Demand Restrictions: Permission of instructor and department required

Special Topics in Computer Engineering Covers special topics in computer engineering. Credits: variable to 4.0; repeatable to a max of Elec-Rec-Lab: (0-0-0) Semesters Offered: On Demand Restrictions: Permission of instructor and department required

Computer Engineering Project A project in computer engineering. An individual student or a group of students complete a mutually-agreed-upon project in consultation with a faculty member. Credits: variable to 3.0; repeatable to a max of 6Grading Pass/Fail only Lec-Rec-Lab: (0-0-0) Semesters Offered: On Demand Restrictions: Permission of instructor and department required

Computer-Aided Circuit Design Basic techniques in computer aided analysis and design of networks. Includes automatic formulation of equations and fundamental programming techniques pertinent to computer-aided network analysis and modeling. Special topics may include sensitivity calculation, system analogies, and/or design optimization. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Fall Summer Prerequisites: EE 2110 or permission of instructor

Power System Analysis 1 Covers power transmission line parameters and applications, symmetrical components, transformer and load representations, systems faults and protection, and the per unit system. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Fall Prerequisites: EE 3120 or permission of instructor

Power System Analysis 2 Covers power flow, economic dispatch, power system operation, and power system stability. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Spring Prerequisites: EE 4221 or permission of instructor

Physical Electronics Device physics and physical models of the most basic solid-state device structures. Major topics include the terminal characteristics and their physical origin, device design, and device applications. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Fall Prerequisites: EE 3130 or permission of instructor

Electronic Applications Study of electronic circuits under small- and large-signal conditions. Typical topics include analysis and design of power and RF amplifiers, feedback circuits, oscillators, timing circuits, Schmitt triggers, non-linear models of semiconductor devices, the factors that limit switching speed, the switching of reactive elements, and DC-DC converters. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Spring Prerequisites: EE 3130

Microwave Engineering A study of basic building blocks used in microwave systems. Includes microstrip lines, power dividers, directional couplers, filters, amplifiers, and matching networks. Accompanied by a microwave measurements laboratory. Credits: 4.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Fall Summer Prerequisites: EE 3140

Electromagnetic Systems Engineering The fundamentals of electromagnetics within the context of systems engineering, integrating issues of communications, microwave sources, transmission lines, antennas, propagation, and the reception and processing of signals. Credits: 4.0 Lec-Rec-Lab: (0-3-2) Semesters Offered: Fall Prerequisites: EE 3140 or permission of instructor

Physics of Microwave Devices Covers solid-state microwave devices, microwave tubes, and microwave components. Describes the basic physical mechanisms involved in device operation at microwave frequencies. Can include device design and device applications. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Spring Prerequisites: EE 3140 or permission of instructor

Wireless Communications Principles of wireless communication systems. Applications include cell phones, computer networks, paging systems, satellite communications, radio, television, and telemetry. Credits: 4.0 Lec-Rec-Lab: (0-3-2) Semesters Offered: Fall Prerequisites: EE 3150 or permission of instructor

Digital Signal Processing Digital signal processing techniques. Includes sampling, the Z-transform, digital filters, and discrete Fourier transforms. Emphasizes techniques for design and analysis of digital filters. Special topics may include the FFT, windowing techniques, quantization effects, and physical limitations. Credits: 4.0 Lec-Rec-Lab: (0-3-2) Semesters Offered: Fall Prerequisites: EE 2110 or permission of instructor

Real Time Signal Processing Practical implementation of digital signal processing concepts as developed in ENG252. Emphasis on applications of DSP to communications, filter design, speech processing, and radar. Laboratory provides practical experience in the design and implementation of DSP solutions. Credits: 3.0 Lec-Rec-Lab: (0-2-2) Semesters Offered: Spring Prerequisites: EE 4252 or permission of instructor

Image Processing Theory and applications of digital image processing. Topics include image transforms and filtering, image contrast and edge enhancement, image compression and encoding, and image segmentation and representation. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Spring Prerequisites: EE 4252 or permission of instructor

Classical Control Systems Mathematical formulation of control problems (both transfer function and state-variable descriptions); analysis of feedback control systems (stability, transient performance, steady-state error, sensitivity, etc.). Design using frequency response, root locus, state-variable methods; analog and digital simulation and computation; and experiments with physical systems. Credits: 3.0 Lec-Rec-Lab: (0-2-2) Semesters Offered: Fall Prerequisites: EE 2160 or permission of instructor

Digital and Non-linear Control Digital control system design and analysis (Z-transforms, difference equations, and the discrete-time state model); introduction to nonlinear systems (equilibrium states, linearization, phase plane analysis, and describing function analysis); discrete-event controller design (state-transition techniques, relay ladder logic, and Petri nets); introduction to hierarchic systems; and experiments with physical systems. Credits: 3.0 Lec-Rec-Lab: (0-2-2) Semesters Offered: Spring Prerequisites: EE 4261 or permission of instructor

VLSI Design Design of VLSI circuits using CAD tools. Analysis of physical factors affecting performance. Credits: 4.0 Lec-Rec-Lab: (0-3-2) Semesters Offered: Fall Spring Prerequisites: EE 3170 and EE 3130 or permission of instructor

Computer Networks Communications architecture, transmission media, network topologies, protocols, and design issues. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Spring Prerequisites: EE 3170

Embedded Systems and Microprocessor Interfacing Microprocessor architecture and interfacing real-time operating systems. Embedded microprocessors. Credits: 4.0 Lec-Rec-Lab: (0-3-2) Semesters Offered: Spring Prerequisites: EE 3170 or permission of instructor

Special Topics in Electrical Engineering Covers special topics in electrical engineering. Credits: variable to 4.0; repeatable to a max of 6.0Grading Pass/Fail only Lec-Rec-Lab: (0-0-0) Semesters Offered: On Demand Restrictions: Permission of instructor and department required

Electrical Engineering Project A project in electrical engineering. An individual student or a group of students complete a mutually-agreed-upon project in consultation with a faculty member. Credits: variable to 3.0; repeatable to a max of 6Grading Pass/Fail only Lec-Rec-Lab: (0-0-0) Semesters Offered: On Demand Restrictions: Permission of instructor and department required

Special Topics in Computer Engineering Covers special topics in computer engineering. Credits: variable to 4.0; repeatable to a max of 6.0Grading Pass/Fail only Lec-Rec-Lab: (0-0-0) Semesters Offered: On Demand Restrictions: Permission of instructor and department required

Computer Engineering Project A project in computer engineering. An individual student or a group of students complete a mutually-agreed-upon project in consultation with a faculty member. Credits: variable to 3.0; repeatable to a max of 6Grading Pass/Fail only Lec-Rec-Lab: (0-0-0) Semesters Offered: On Demand Restrictions: Permission of instructor and department required

Design Fundamentals The design process. Includes team design activities and studies project management. Credits: 1.0 Lec-Rec-Lab: (1-0-0) Semesters Offered: Fall Spring Prerequisites: EE 4010(C) or EE 4921(C) or EE 4951(C) or EE 4971(U) or permission of instructor

EE Design Project 1 The first quarter of a program of study in which a group of students work on an engineering design project in consultation with a faculty member. Credits: 2.0 Lec-Rec-Lab: (0-1-3) Semesters Offered: Fall Spring Restrictions: Must be enrolled in one of the following Class(es): Senior Corequisites: EE 4980 Prerequisites: EE 3301 and EE 3130 or permission of instructor

EE Design Project 2 The second semester of a program of study in which a group of students work on an engineering design project in consultation with a faculty member. Credits: 3.0 Lec-Rec-Lab: (0-1-6) Semesters Offered: Fall Spring Prerequisites: EE 4901
EE 4921 Power Engineering Design Project 1 The first semester of a program of study in which a group of students work on an electric power engineering design project in consultation with a faculty member. Credits: 2.0 Lec-Rec-Lab: (0-1-3) Semesters Offered: Fall Restrictions: Must be enrolled in one of the following Classies: Senior Corequisites: EE 4900 Prerequisites: EE 4221(C) and EE 5301 and EE 3130 or permission of instructor

EE 4922 Power Engineering Design Project 2 The second semester of a program of study in which a group of students work on an electric power engineering design project in consultation with a faculty member. Credits: 3.0 Lec-Rec-Lab: (0-1-6) Semesters Offered: Spring Prerequisites: EE 4921 and EE 4222(C) or permission of instructor

EE 4951 Communication Systems Design Project 1 The first semester of a program of study in which a group of students work on a communication systems engineering design project in consultation with a faculty member. Credits: 2.0 Lec-Rec-Lab: (0-1-3) Semesters Offered: Fall Restrictions: Must be enrolled in one of the following Classies: Senior Corequisites: EE 4900 Prerequisites: EE 4251(C) and EE 3301 or permission of instructor

EE 4952 Communication Systems Design Project 2 The second semester of a program of study in which a group of students work on a communications system engineering design project in consultation with a faculty member. Credits: 3.0 Lec-Rec-Lab: (0-1-6) Semesters Offered: Spring Prerequisites: EE 4951

EE 4971 Computer Design Project 1 The first semester of a program of study in which a group of students work on a computer engineering design project in consultation with a faculty member. Credits: 2.0 Lec-Rec-Lab: (0-1-3) Semesters Offered: Fall Restrictions: Must be enrolled in one of the following Classies: Senior Corequisites: EE 4900 Prerequisites: EE 3170 and EE 3130 or permission of instructor

EE 4972 Computer Design Project 2 The second semester of a program of study in which a group of students work on a computer engineering design project in consultation with a faculty member. Credits: 3.0 Lec-Rec-Lab: (0-1-6) Semesters Offered: Spring Prerequisites: EE 4971

Electrical Engg Technology (EET)

EET 1111 Circuits I Introduces electrical networks with DC and sinusoidal AC sources. Defines resistance, voltage, current, energy, and power, followed by a study of network analysis and network theorems. Includes the analysis of transients in capacitive and inductive networks. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Fall Spring Prerequisites: MAT 1115(C) and CET 1100(C) or permission of instructor

EET 1112 Circuits I Laboratory A laboratory course for EET1111. Circuits are constructed from schematics. Emphasizes DC circuits with an introduction to AC. Studies proper instrumentation and use of multimeters, power supplies, AC function generators, and oscilloscopes. Laboratory exercises are directly related to recitation materials. Credits: 1.0 Lec-Rec-Lab: (0-0-3) Semesters Offered: Fall Spring Prerequisites: EET 1111(C) or permission of instructor

EET 2111 Circuits II Continuation of EET1111. Covers bridge circuits, resonance, filters, and the analysis of single-phase and polyphase electric networks in the sinusoidal steady state. Includes a treatment of circuit measurement theory, instruments, and practice. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Fall Spring Prerequisites: EET 1111(C) and MAT 1115 or permission of instructor

EET 2112 Circuits II Laboratory A laboratory course for EET 2111. Circuits are constructed from schematics. Emphasizes AC circuits. Studies proper instrumentation and use of multimeters, power supplies, AC function generators, and oscilloscopes. Laboratory exercises are directly related to recitation materials. Credits: 1.0 Lec-Rec-Lab: (0-0-3) Semesters Offered: Fall Spring Prerequisites: EET 2111(C) or permission of instructor

EET 2141 Digital Electronics and Microprocessor Fundamentals Introduction to digital logic circuits and their applications developing into microprocessor architecture. Topics include number systems, codes, Boolean algebra, Karnaugh maps, arithmetic circuits, counters, registers, bus structures, I/O devices, A/D and D/A conversions, serial communications, and memory devices. Credits: 4.0 Lec-Rec-Lab: (0-3-3) Semesters Offered: Fall Spring Prerequisites: EET 1111 or permission of instructor

EET 2221 Electronic Devices and Circuit Theory Introduces solid-state electronic devices and their application. Studies diodes, transistors, and operational amplifier Ics. Transistor biasing, temperature stabilization and gain calculations of single and multistage amplifiers. Studies power amplifiers, frequency response, heat sinking, and power supply design. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Fall Spring Prerequisites: EET 1111 or permission of instructor

EET 2222 Electronic Devices and Circuits Laboratory A laboratory course to accompany or be preceded by EET2221. Exercises include operational amplifiers, frequency response of amplifiers, diodes, and their application, power supplies, transistors and their use in amplifying circuits. Credits: 1.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Fall Spring Prerequisites: EET 1111 and EET 2221(C) or permission of instructor

EET 2233 Electrical Machinery Fundamental steady-state analysis of DC, AC polyphase and AC single-phase electrical machines as well as transformers. Credits: 4.0 Lec-Rec-Lab: (0-3-3) Semesters Offered: Fall Prerequisites: EET 1111(C) or permission of instructor

EET 2241 Structure and Assembly Programming Introduction to computer programming using both high-level and assembly languages. Topics include syntax, programming structure, style and documentation. High-level language programs emphasize solutions to problems common to engineering technology. Assembly language programs stress understanding of microprocessor architecture implementation. Credits: 3.0 Lec-Rec-Lab: (0-2-2) Semesters Offered: Fall Spring Prerequisites: EET 2241(C)

EET 2311 Electricity and Electronic Devices Principles and applications of electrical circuits and devices. Topics include DC and AC circuits, magnetics, 3 phase, diodes, bipolar transistor and ETF amplifiers, operational amplifiers and power supply circuits. Includes basic instrumentation, device operation and circuit operation/biasing. Credits: 4.0 Lec-Rec-Lab: (0-3-2) Semesters Offered: Fall Restrictions: May not be enrolled in one of the following Major(s): Electrical Engineering Tech, Electromechanical Eng Tech Prerequisites: MAT 1115 or permission of instructor

EET 2390 Power Systems A study of transmission of electric power from generators to loads, system components, and system performance. Covers basic power systems and their analysis, the per-unit system, faults on power systems, circuit interrupting devices, system instrumentation, automatic protection systems, and safety and grounding. Credits: 3.0 Lec-Rec-Lab: (0-3-3) Semesters Offered: Spring Prerequisites: EET 2233 or permission of instructor

EET 3225 Special Electronic Devices An advanced course in the study of linear integrated circuits. Includes op amps, comparators, wave form generators, timers and regulators. Emphasizes practical applications, including the interface of time-continuous measures to the discrete digital world. Credits: 4.0 Lec-Rec-Lab: (0-3-3) Semesters Offered: Spring Prerequisites: EET 2221 or permission of instructor

EET 3267 Communications Systems A basic course in communications systems. Includes information theory, AM receiving and transmitting, SSB, frequency and phase modulation transmitting and receiving, TV frequency synthesis, digital modulation, telephone systems, and LAN/Internet communications. Includes system modeling using block diagrams and analysis of typical circuits. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Spring Prerequisites: EET 3268 Prerequisites: EET 2221 or permission of instructor

EET 3268 Communications Systems Laboratory A laboratory course to accompany EET2267. Experiments performed include basic equipment usage, noise measurements, oscillators, AM modulators, Class C power amplifiers, AM detection, frequency conversion, FM modulators, FM demodulators, phase locked loops, TV sync circuits, pulse amplitude modulation, pulse code modulation, and OTMF signaling. Credits: 1.0 Lec-Rec-Lab: (0-0-3) Semesters Offered: Spring Corequisites: EET 3268

EET 3281 Electrical Project Development and Troubleshooting Covers soldering, component layout, printed circuit board artwork, troubleshooting, electrical and environmental factors in design as well as an overview of the practical methods used by industry to process projects. The student designs and fabricates a circuit board and assembles a project. Credits: 3.0 Lec-Rec-Lab: (0-1-3) Semesters Offered: Spring Prerequisites: EET 2221 or permission of instructor

EET 3341 System Administration and Network Administration Basics Study of computer systems administration using stand-alone and networked systems. Topics include user and process management, backup/recovery, adding devices, installation, maintenance, networking hardware, including cabling, modems, routers, and other communication devices. Studies ethernet, TCP/IP, and networking protocols. Emphasizes the role of system administrators in an organization. Credits: 4.0 Lec-Rec-Lab: (0-3-3) Semesters Offered: Spring Prerequisites: EET 2241 or permission of instructor

EET 3353 Sensors, Data Acquisition and Control An introduction to graphical programming in G. National Instruments LabVIEW software is used in learning the fundamentals of graphical programming. Data acquisition and control programs are written, and transducer utilization and signal conditioning studied. Credits: 4.0 Lec-Rec-Lab: (0-3-3) Semesters Offered: Fall Spring Prerequisites: EET 2221 or EET 2311

EET 3357 Introduction to Programmable Controllers The design of discrete sequential control using programmable logic controllers, PLCs. Relay logic is used to introduce ladder logic and ladder logic is used to program the PLC. Introduces a structured approach to sequential control design. Data acquisition is introduced using BridgeVIEW software. Credits: 3.0 Lec-Rec-Lab: (0-2-3) Semesters Offered: Fall Prerequisites: EET 1111 or EET 2311 or permission of instructor

EET 3467 Wireless Communications A continuation of EET2267. Topics include transmission lines, wave propagation, antennas, fiber optics, digital communications, and applications of those ideas to mobile wireless communications systems. Credits: 4.0 Lec-Rec-Lab: (0-2-3) Semesters Offered: Fall Spring Prerequisites: EET 3267 and MAT 2215

EET 4373 Advanced Programmable Controllers Using Allen Bradley Micro Logix, SLC500, PLC-5 programmable controllers, course covers structured programming, Sequential Function Charts, networking, proportional integral differential control, data acquisition and interfacing. The labs will require students to write and troubleshoot complex PLC programs. Credits: 4.0 Lec-Rec-Lab: (0-2-3) Semesters Offered: Spring Prerequisites: EET 3373 or permission of instructor
Engineering (ENG)

ENG 1000 Foundations for Success: An introduction to University life, exploring ways to become a more effective student focusing on personal and professional habits necessary for success. Topics include academic skill development, time management, and university resources. Credits: 1.0; graded Pass/Fail only; Lec-Rec-Lab: (0-0-2) Semesters Offered: Fall

ENG 1002 Introduction to 3-D Spatial Visualization: Intended for first-year engineering students with a demonstrated need for the development of 3-D spatial visualization skills. Topics include isometric sketching, orthogonal projection, object transformations, 3-D coordinate systems, panels folding to 3-D objects, and cross sections of solids. Credits: 1.0; Lec-Rec-Lab: (0-0-2) Semesters Offered: Fall

ENG 111 Fundamentals of Engineering I: An introduction to the engineering profession and to its various disciplines. Focuses on developing problem-solving skills, computational skills, and communication skills. Through active, collaborative work, students work on teams to apply the engineering problem-solving method to "real-world" problems. Credits: 3.0; Lec-Rec-Lab: (0-0-2) Semesters Offered: Fall; Spring

ENG 1101 Fundamentals of Engineering II: Continuation of ENG1101. Introduction to the engineering design process with an emphasis on graphics and documentation. Focuses on engineering problem solving in the context of the design process. Credits: 3.0; Lec-Rec-Lab: (0-0-2) Semesters Offered: Fall; Spring

ENG 1990 Special Topics in Engineering: Engineering topics of interest to students and faculty that are not normally covered in the existing courses. Credits: variable to 3.0; repeatable to a max of 6 Lec-Rec-Lab: (0-0-0) Semesters Offered: On Demand

ENG 2950 Engineering Enterprise Orientation: An orientation for students to their specific engineering enterprise. Covers enterprise specific topics that should include organizational structure, past, present, and future projects and their results, an evaluation of learning and personality preferences, and exploring the MTU challenge course. Credits: 1.0; Lec-Rec-Lab: (0-0-3) Semesters Offered: Fall; Spring

ENG 2960 Engineering Enterprise Project Work I: Interdisciplinary teams work as part of an engineering enterprise to address real-world engineering design projects or problems. Second-year students are responsible for achieving some prescribed objectives and performing critical analysis of data. Credits: 1.0; Lec-Rec-Lab: (0-0-3) Semesters Offered: Spring

ENG 2961 Engineering in the Enterprise Enterprise: Develops group problem-solving skills. Stresses interpersonal skills and skill assessment, communication, group process and teamwork, and action planning. Uses active, hands-on learning. Credits: 1.0; Lec-Rec-Lab: (0-0-1) Semesters Offered: Spring; Restrictions: May not be enrolled in one of the following Classes: Freshman

ENG 2962 Communication Contexts: An introduction to the demands of technical and professional communication in workplace settings, through analyzing project design team experiences. Credits: 1.0; Lec-Rec-Lab: (0-0-0) Semesters Offered: Spring

ENG 2990 Special Topics in Engineering: Engineering topics of interest to students and faculty that are not normally covered in the existing courses. Credits: variable to 3.0; repeatable to a max of 6 Lec-Rec-Lab: (0-0-0) Semesters Offered: On Demand

ENG 3401/EC 3401 Economic Decision Analysis I: For students who want to take EC 3400 in modules. Covers techniques for effective decision making related to the time value of money. Covers interest-rate calculations, loan repayments, and basic decision tools for comparing alternatives. Present and annual worth, rate-of-return, etc. Credits: 3.0; Lec-Rec-Lab: (0-0-2) Semesters Offered: Fall

ENG 3402/EC 3402 Economic Decision Analysis II: For students who want to take EC 3400 in modules. Deepens coverage of principles and techniques for making effective decisions by introducing sources of funding and cost of capital, benefit and cost estimation, depreciation and taxation, and project evaluation. Taught during the second five weeks of EC 3400. Credits: 1.0; Lec-Rec-Lab: (0-0-2) Semesters Offered: Spring

ENG 3403/EC 3403 Economic Decision Analysis III: For students who want to take EC 3400 in modules. Provides an understanding of the setting in which effective decisions are made. Covers business organization, financial statements, inflation, risk and uncertainty, project and business financing, and capital budgeting. Taught during the third five weeks of EC 3400. Credits: 1.0; Lec-Rec-Lab: (0-0-2) Semesters Offered: Fall

ENG 3950 Engineering for the Environment: The fundamentals of environmentally responsible design and manufacturing of goods. Topics include definition and measurement of pollution, material and energy balances, product life cycle, risk analysis, manufacturing processes and systems, and pollution control systems. Credits: 3.0; Lec-Rec-Lab: (0-3-0) Semesters Offered: Fall. Prerequisites: CH 1100 and (MA 1150 or MA 1160)

ENG 3950 Engineering Enterprise Project Work II: Interdisciplinary teams work as part of an engineering enterprise to address real-world engineering design projects or problems. Third-year students will practice designing solutions to achieve specified project objectives. Credits: 1.0; Lec-Rec-Lab: (0-3-0) Semesters Offered: Fall

ENG 3951 Enterprise Management Principles: Fundamental principles of marketing in a lecture format augmented by a simulation played in small groups. The course is completed in two-day-long, Saturday sessions separated by one week. Examines marketing in the six stages of product life cycle (opportunity identification, product development, introduction, growth, maturity, and decline). Credits: 1.0; Lec-Rec-Lab: (0-0-1) Semesters Offered: Fall. Restrictions: Permission of instructor required; must be enrolled in one of the following Classes: J; senior

ENG 3955 Conceptual Design and Creative Problem Solving: Provides students with an understanding of the creative problem-solving process through application to a team design project. This module should be taken prior to students undertaking a major team project in their engineering enterprise or as E-teams (NCIA). Credits: 1.0; Lec-Rec-Lab: (0-1-0) Semesters Offered: Fall

ENG 3956 Industrial Health and Safety: Instruction of health and safety in engineering practice. Integrates the study of health and safety regulations, risks, and potential for improvement. Also covers the tremendous financial, ethical, and public relations implications of disregarding this critical aspect of engineering. Credits: 1.0; Lec-Rec-Lab: (0-0-3) Semesters Offered: Fall

ENG 3960 Engineering Enterprise Project Work III: Interdisciplinary teams work as part of an engineering enterprise to address real-world engineering design projects or problems. Third-year students practice designing solutions to achieve specified project objectives. Credits: 1.0; Lec-Rec-Lab: (0-0-3) Semesters Offered: Spring

ENG 3961 Engineering Enterprise Strategic Leadership: This 1-credit module focuses on exploring research findings about leadership, the practice of leadership, and providing skill assessment and development opportunities. Topics include leadership traits, behaviors, theories, and leadership of change. Combines a variety of teaching methods, including self-assessment, cases, discussion, experiential exercises, role-playing, videotaping. Credits: 1.0; Lec-Rec-Lab: (0-1-0) Semesters Offered: Spring

ENG 3962 Communication Strategies: Drawing on the broad understanding of workplace communication developed in ENG2962, students will learn and practice strategies for effective oral and written communications in technical and professional settings. Emphasis is on audience adaptation of technical information and on achieving clearly specified purposes. Credits: 1.0; Lec-Rec-Lab: (0-1-0) Semesters Offered: Spring

ENG 3963 Project Management: Project definition, development of a work breakdown structure, resource development and milestone development. Covers technology and project scheduling and practical application of Gantt and PERT/CPM charts; resource management and application of critical chain method; project budgeting and cost estimation; project monitoring, control, evaluation, and termination; and project teams, their structure, and interactions. Credits: 1.0; Lec-Rec-Lab: (0-1-0) Semesters Offered: Spring

ENG 3964 Design for Manufacturing: Supplements course topics that address "design for function." Products "designed for manufacturing" are lower cost, higher quality, and have a shorter time to market. Discusses how capabilities and limitations of common manufacturing processes translate into qualitative design guidelines. Topics include design for assembly, material/process selection, and estimation of tooling/operating costs. Credits: 1.0; Lec-Rec-Lab: (0-1-0) Semesters Offered: Spring

ENG 3965 Material Flow in an Industrial Society: Introduction to material flow, recycling, and pollution. Covers regulation of material flow and pollution; flow diagrams for specific industries, i.e., paper mill, power plant, steel, aluminum, cement, fertilizer; global warming components of basic industries; interdependence on basic industrial material flow from each other; and development of regional/national material flow diagrams. Credits: 1.0; Lec-Rec-Lab: (0-1-0) Semesters Offered: Spring

ENG 3966 Design for Manufacturing: Supplements course topics that address "design for function." Products "designed for manufacturing" are lower cost, higher quality, and have a shorter time to market. Discusses how capabilities and limitations of common manufacturing processes translate into qualitative design guidelines. Topics include design for assembly, material/process selection, and estimation of tooling/operating costs. Credits: 1.0; Lec-Rec-Lab: (0-1-0) Semesters Offered: Spring

ENG 3970 Engineering Enterprise Special Topics: For the development of new, junior-level instructional modules in support of the engineering enterprise. Credits: 1.0; Lec-Rec-Lab: (0-1-0) Semesters Offered: Fall

ENG 3990 Special Topics in Engineering: Engineering topics of interest to students and faculty that are not normally covered in the existing courses. Credits: variable to 3.0; repeatable to a max of 6 Lec-Rec-Lab: (0-0-0) Semesters Offered: On Demand
ENG 4900: Multidisciplinary Senior Design Project I
Introduction to engineering design, including modeling, simulation, economic decision making, and reliability. Integration of design principles in the solution of open-ended engineering problems. Projects are defined and planned with faculty and industrial guidance. Emphasizes economics and environmental constraints. Credits: 3.0 Lec-Rec-Lab (0-1-6) Semesters Offered: Fall Restrictions: Must be enrolled in one of the following Classes: Senior

ENG 4910: Multidisciplinary Senior Design Project II
Continuation of ENG4900. Introduction to engineering design, including modeling, simulation, economic decision making, and reliability. Integration of design principles in the solution of open-ended engineering problems. Projects are defined and planned with faculty and industrial guidance. Emphasizes economics and environmental constraints. Credits: 3.0 Lec-Rec-Lab (0-1-6) Semesters Offered: Fall Restrictions: Must be enrolled in one of the following Classes: Senior

ENG 4950: Engineering Enterprise Project Work IV
Interdisciplinary teams work as part of an engineering enterprise to address real-world engineering design projects or problems. Fourth-year students gain experience in defining project objectives, planning strategies to achieve these objectives, and leading technical teams to accomplish project goals. Credits: 2.0 Lec-Rec-Lab (0-0-6) Semesters Offered: Fall Restrictions: Must be enrolled in one of the following Classes: Junior Senior

ENG 4951: Budgeting-Entrepreneurial Engineering
Introduction to the mechanics and dynamics of the financial budgeting process. Emphasizes their use in planning and evaluating engineering projects and enterprises. Topics and activities include budget preparation, performance assessment, and emerging issues analysis. Credits: 1.0 Lec-Rec-Lab (0-1-0) Semesters Offered: Fall Restrictions: Must be enrolled in one of the following Classes: Senior

ENG 4952: Complex Communication Practices
Students apply strategies and knowledge learned in ENG2962 and ENG9632 to the achievement of more complex communication practices demanded in technical and professional settings. Emphasizes creating professional identities, management communication skills, and responsible messages within teams and organizations and for a variety of technical and nontechnical audiences. Credits: 1.0 Lec-Rec-Lab (0-1-0) Semesters Offered: Fall Restrictions: Must be enrolled in one of the following Classes: Junior Senior

ENG 4953: Writing About Engineering in a Societal Context
Engineering projects take place within overlapping political, social, economic, and cultural contexts, and these contexts affect and are affected by engineering work. Students reflect upon the variety of cultural perspectives that could be brought to bear on present and future projects as professionals. Credits: 1.0 Lec-Rec-Lab (0-1-0) Semesters Offered: Fall Restrictions: Must be enrolled in one of the following Classes: Junior Senior

ENG 4954: Global Competition
Emphasizes unique economic, market, and political risks faced by organizations as operations expand beyond domestic borders. Discusses establishing risk profiles to analyze new labor, product, capital markets on a global scale and appropriate market entry strategies. Small teams will do a risk profile and recommend market entry strategies for selected countries. Credits: 1.0 Lec-Rec-Lab (0-1-0) Semesters Offered: Fall Restrictions: Must be enrolled in one of the following Classes: Junior Senior

ENG 4960: Engineering Enterprise Project Work V
Interdisciplinary teams work as part of an engineering enterprise to address real-world engineering design projects or problems. Fourth-year students gain experience in defining project objectives, planning strategies to achieve these objectives, and leading technical teams to accomplish project goals. Credits: 2.0 Lec-Rec-Lab (0-0-6) Semesters Offered: Spring Restrictions: Must be enrolled in one of the following Classes: Senior

ENG 4970: Engineering Enterprise Special Topics
For the development of new, senior-level instructional modules in support of the engineering enterprise. Credits: 1.0 Lec-Rec-Lab (0-1-0) Semesters Offered: Fall Restrictions: Must be enrolled in one of the following Classes: Senior

ENG 4990: Special Topics in Engineering
Engineering topics of interest to students and faculty that are not normally covered in the existing courses. Credits: variable to 3.0; repeatable to a max of 6 Lec-Rec-Lab: (0-0-6) Semesters Offered: Offered: On Demand

Fine Arts (FA)

FA 1150: Drawing I
Introduction to and practice of fundamental principles of drawing. Develops skills in representational drawing, perspective, and composition. Introduces creative and modern drawing techniques using a wide range of subject matter. Slide lectures and discussions illustrate classic principles while encouraging development of individual expression. Credits: 3.0 Lec-Rec-Lab (0-2-3) Semesters Offered: Fall Spring

FA 1700: Technical Theatre Production
Introduction to the basic techniques, theories, and terminology of technical theatre production. Focus on practical application of stagecraft for a mainstage production, safety in technical theatre, physical theatre structures, production processes, and theatre organization. Credits: 3.0 Lec-Rec-Lab (0-3-0) Semesters Offered: Fall Spring

FA 2090: Speech Communication
Emphasizes verbal and physical expression by learning presentation techniques and effective use of visual aids. Students engage in improvisational speeches, interviews, reports, speeches to inform, and speeches to persuade in front of the class audience. Credits: 3.0 Lec-Rec-Lab (0-3-0) Semesters Offered: Fall Spring

FA 2150: Drawing II
Analyzes the visual principles and vocabulary of drawing. Students are trained to observe, distinguish, and relate to the visual world through the process of drawing. Through study of a variety of subjects, students discover how to see, compose, use materials of drawing, work intuitively, and critique. Credits: 3.0 Lec-Rec-Lab (0-2-3) Semesters Offered: Fall Restrictions: FA 1150 or permission of instructor

FA 2200: Watermedia
Introduction to the unique visual and expressive possibilities inherent in the use of watermedia painting. Equal emphasis on perception, practice, and explanation of understanding of watermedia, color principles, line, form, and composition, including watermedia principles of both traditional and contemporary masters. Development of individual thinking and creative expression. Credits: 3.0 Lec-Rec-Lab (0-2-3) Semesters Offered: Fall Spring

FA 2250: Oil Painting I
An introductory oil painting course. Introduces the materials, techniques, terminology, and skills required to create oil paintings. Taught on a perceptual level. Develops a strong foundation and philosophy of art, visual awareness, and individual creative abilities. Subject matter may be still life, landscape, and figure. Credits: 3.0 Lec-Rec-Lab (0-2-3) Semesters Offered: Fall Spring

FA 2300: Two-Dimensional Design
Introduction to basic design, composition, and color theory through imagery and design in two-dimensional media. Equal emphasis placed on thought processes and manual skill. The organization of space in two dimensions is taught through a variety of methods and materials. Emphasizes creativity, inventiveness, and experimentation. Credits: 3.0 Lec-Rec-Lab (0-2-3) Semesters Offered: Spring Semester

FA 2330: Art Appreciation
Gives a basic appreciation of several art media, of artists, creative and technical processes, and major works of art. Learn the elements of art and the organizing principles of design. Includes an in-depth exploration into the life and works of one major artist in each medium. Credits: 3.0 Lec-Rec-Lab (0-3-0) Semesters Offered: Fall Spring

FA 2400: Huskies Pep Band
The Huskies Pep Band provides enthusiastic support for a number of athletic programs at MTU and participates in important events in the community. The HPB is one of the most visible programs in the University. We are known as one of the country’s most spirited college band programs anywhere. Credits: 1.0; may be repeated; graded Pass/Fail only Lec-Rec-Lab: (0-0-3) Semesters Offered: Fall Spring

FA 2402: Campus Concert Band
The Concert Band provides the opportunity for students to pursue an interest in instrumental performance through the medium of a concert wind band. Repertoire of the ensemble includes music of the highest calibre with moderate technical demands. Open to students with prior experience in a band or orchestra. Credits: 1.0; may be repeated; graded Pass/Fail only Lec-Rec-Lab: (0-0-3) Semesters Offered: Spring

FA 2420: J Lab Band
A select ensemble of approximately twenty instrumentalists studying jazz improvisation and performing literature for the jazz ensemble. Repertoire includes swing, jazz-rock, ballads, fusion, and experimental compositions. Activities include performances at festivals, concerts, and dances, and a spring-break tour. Course work includes topics in jazz history, music theory, and improvisation. Audition required. Credits: 1.0; may be repeated; Lec-Rec-Lab: (0-0-3) Semesters Offered: Fall Spring

FA 2500: Music Theory I
Introduction to music fundamentals, including musical notation; major, minor and modal scales; intervals; and rhythm. Provides ear training and development of sight-singing capabilities. Introduces music writing, both manual and using computers. Utilizes Computer-Assisted Music Instruction Lab. Credits: 3.0 Lec-Rec-Lab (0-3-0) Semesters Offered: Fall Spring

FA 2520: Music Appreciation
Survey of the nature of Western music with an emphasis on the developments in the aesthetics, theories, and media of music, including electronic music, multimedia works, and non-Western influences. Credits: 3.0 Lec-Rec-Lab (0-3-0) Semesters Offered: Fall Spring

FA 2600: The Technique of Acting
In-depth investigation of the actor’s instrument and the tools available to the actor. Students learn and implement acting theory and methodology. Emphasizes historical and modern acting techniques using research, scene work, improvisation, script and character analysis, and movement and vocal exercises. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Fall Spring

FA 2606: Mainstage Theatre: Acting
Acting students selected to be members of the cast or to serve as assistant directors or stage managers for plays produced by the Department of Fine Arts may enroll in this class with the permission of the faculty director. Credits: variable to 3.0 May be repeated Lec-Rec-Lab: (0-0-3) Semesters Offered: Fall Spring Restrictions: Permission of instructor required

FA 2661: Mainstage Theatre: Crew
Open to students selected for the crew of a mainstage theatre production sponsored by the Department of Fine Arts. Positions on stage crews are open to all MTU students. Work assignments will be made by the technical director of the Department of Fine Arts. Credits: variable to 3.0 May be repeated; graded Pass/Fail only Lec-Rec-Lab: (0-0-3) Semesters Offered: Fall Spring Restrictions: Permission of instructor required

FA 2820: Theatre Appreciation
Survey of the nature of theatre from the classics to the twentieth century, emphasizing procedures of play production. Includes the roles of playwright, actor, director and designer, and examines theories of modern theatre production. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Fall Spring
FA 3000 Fine Arts Tour Students participating in fine arts performance tours taking place outside of regular academic terms are eligible to receive credit based on the time span of the tour and the nature of the itinerary. Requires active membership in the touring group or permission of director. Credits: 1.0; may be repeated: graded Pass/Fail only Lec-Rec-Lab: (0-1-0) Semesters Offered: On Demand

FA 3090 Performance Communication Students improve public speaking skills by working with improvisational, traditional, and innovative theatre techniques and by journaling about these experiences. Explores potentials for the use of body, voice, mind, movement, energy, and feelings through a wide range of exercises to increase communication, creativity, and spontaneity. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Spring; offered alternate years beginning with the 2001-02 academic year Restrictions: Must be enrolled in one of the following Classes: ) Junior Senior

FA 3150 Life Drawing Drawing the human form. Combines the elements and principles of drawing with observation and construction of the human form. Emphasizes proportion, structural framework, visual measurement, movement, and relationships. Students work in a variety of drawing media. Credits: 3.0 Lec-Rec-Lab: (0-2-3) Semesters Offered: Spring; Prerequisites: FA 2150 or permission of instructor

FA 3200 Watermedia II In-depth study of watermedia painting with attention given to individual tendencies and preferences. Emphasizes personal solutions and experimental approaches to image making and mixed media explorations. Exploration of traditional and contemporary concepts in watermedia painting with emphasis on relationship between form and content. Credits: 3.0 Lec-Rec-Lab: (0-2-3) Semesters Offered: Spring; Prerequisites: FA 2250 or permission of instructor

FA 3250 Oil Painting II A continuation of FA2250. Develops a stronger foundation and philosophy of painting. Students become more visually sensitive to the elements of art as they learn to paint the human form in a variety of spatial settings. Credits: 3.0 Lec-Rec-Lab: (0-2-3) Semesters Offered: Spring; Prerequisites: FA 2250 or permission of instructor

FA 3300 Three-Dimensional Design Introduction to three-dimensional creative processes through expressive use and exploration of a wide range of materials and techniques based on current theories. Students study elements and organizing principles of art; three-dimensional drawing techniques; theories of architecture and interior design; and additive, subtractive, and experimental sculpture. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Spring; Prerequisites: UN 1002 or UN 1003 or permission of instructor

FA 3330 Art History I The world history of art, sculpture, and architecture. Focuses from the Paleolithic period to the Renaissance. Discusses how art relates to religion and informs a more complete view of society and technology. Lecture/discussion/slides, group work, and presentations. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Spring; Prerequisites: UN 1002 or UN 1003 or permission of instructor

FA 3333 Sculpture Theory, tools, and media of sculpture. Focuses primarily on clay, wood, and stone but open to projects in metal, plastic, and multimedia for qualified students. Students must apply theory to studio projects and justify each project in writing. Credits: 3.0 Lec-Rec-Lab: (0-2-3) Semesters Offered: Fall, offered alternate years beginning with the 2001-02 academic year

FA 3340 Art History II Survey of art in the Western world from the Renaissance to the 20th century. Emphasizes the characteristics of period style and the influence of the time on the artist. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Fall; Prerequisites: UN 1002 or UN 1003 or permission of instructor

FA 3400 Keweenaw Symphony Orchestra A university/community orchestra studying and performing orchestral literature, including the classics, contemporary, choral, orchestral, and pops. The orchestra performs three to four concerts each year, often featuring professional guest artists. Audition required. Credits: 1.0; may be repeated Lec-Rec-Lab: (0-0-3) Semesters Offered: Fall Spring

FA 3401 Wind Symphony The Wind Symphony is a concert wind ensemble of variable size and instrumentation for students with a serious interest in musical performance at a high level. Features a comprehensive approach to the literature to be performed, including study of composers and historical background. Audition required. Credits: 1.0; may be repeated Lec-Rec-Lab: (0-3-0) Semesters Offered: Fall Spring

FA 3420 Research and Development Jazz Band The Research and Development Jazz Band is for instrumentalists wishing to learn the fundamentals of jazz improvisation and the nuances of the jazz idiom. Repertoire includes swing, jazz rock, Latin, ballads, fusion, and other contemporary jazz styles. Public performances are given on campus and in the surrounding area. Audition required. Credits: 1.0; may be repeated Lec-Rec-Lab: (0-3-0) Semesters Offered: Fall Spring

FA 3450 Gospel Choir An ensemble made up of student and community singers studying and performing traditional and contemporary choral music. Activities include campus and community performances and occasional concert tours. Audition required. Credits: 1.0; may be repeated; graded Pass/Fail only Lec-Rec-Lab: (0-0-3) Semesters Offered: On Demand

FA 3450 Gospel Choir A select ensemble made up of student and community singers studying and performing choral literature ranging from chant to avant garde compositions. Activities include campus and community performances and occasional regional and international tours. Audition required. Credits: 1.0; may be repeated Lec-Rec-Lab: (0-0-3) Semesters Offered: Fall Spring

FA 3500 Music History Develops critical skills applicable to study of all film while emphasizing the African-American experience as chronicled and interpreted through film. Credits: 3.0 Lec-Rec-Lab: (0-2-3) Semesters Offered: Spring; Prerequisites: FA 2500 and (UN 1002 or UN 1003) or permission of instructor

FA 3510 Concert Choir A select ensemble made up of student and community singers studying and performing choral literature ranging from chant to avant garde compositions. Activities include campus and community performances and occasional regional and international tours. Audition required. Credits: 1.0; may be repeated Lec-Rec-Lab: (0-0-3) Semesters Offered: Fall Spring

FA 3530 Music Theory II Study of fundamentals of tonal harmony, including expanded harmonies. Study of complex rhythms. Introduction to formal and harmonic analysis. Ear training and sightreading. Utilizes synthesizers, computers, and music software. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Spring; Prerequisites: FA 2500 and (UN 1002 or UN 1003) or permission of instructor

FA 3540 African-American Film African-American history as seen through the medium of film. Develops critical skills applicable to study of all film while emphasizing the African-American experience as chronicled and interpreted through film. Credits: 3.0 Lec-Rec-Lab: (0-2-3) Semesters Offered: Spring; Prerequisites: UN 1002 or UN 1003 or permission of instructor

FA 3550 History of Jazz Covers the musical, historical, and sociological elements of America's only original musical art form, jazz. Focuses on the major stylistic eras from 1900 to the present in addition to the major artists and their contributions. Emphasizes developing interactive, aural, and critical skills. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Spring; Prerequisites: UN 1002 or UN 1003 or permission of instructor

FA 3670 Acting Ensemble Learn improvisation by working with exercises, games, mindfulness techniques, and interpersonal interaction. Activities include performances and workshops at MTU, in K-12 schools, and as part of MTU's theatre productions. Audition required. Credits: 1.0; may be repeated Lec-Rec-Lab: (0-0-3) Semesters Offered: Fall; Spring Restrictions: Permission of instructor required

FA 3670 Acting Ensemble Introduction to designing theatrical lighting through various design projects. Students are involved in a mainstage theatre design. Focus on practical design presentation techniques, specific drafting conventions for theatrical designs, designer/designer relationships, script analysis and design concepts, design history, and styles of design. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Spring; offered alternate years beginning with the 2000-01 academic year

FA 3700 Lighting Design Introduction to designing theatrical lighting through various design projects. Students are involved in a mainstage theatre design. Focuses on practical design presentation techniques, specific drafting conventions for theatrical designs, exploration of lighting equipment, designer/designer relationships, script analysis and design concepts, and design history. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Spring; Prerequisites: FA 1700 or permission of instructor

FA 3750 Scenic Design Introduction to designing theatrical scenery through various design projects. Students are involved in a mainstage theatre design. Focuses on practical design presentation techniques, specific drafting conventions for theatrical designs, designer/designer relationships, script analysis and design concepts, design history. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Spring; Prerequisites: FA 1700 or permission of instructor

FA 3780 Advance Theatre Interpretation A comprehensive, in-depth study of mounting a theatre production with an emphasis on directing. Through script analysis, studies students the necessary production elements, how they interrelate, and directing techniques to create a unified production. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Fall; offered alternate years beginning with the 2000-01 academic year

FA 3800 Dramatic Literature A comprehensive study of dramatic literature with an emphasis on its relationship to performance, to the audience, and to the society in which it was written. Includes classical and contemporary dramatic literature. Students apply a variety of analytical approaches to the plays. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Spring; Prerequisites: UN 1002 or UN 1003

FA 3810 Ancient Theatre History An in-depth examination of theatre history from ancient Egypt through the eighteenth century. Studies how the interrelationships among technologies, ideologies, geography, history, architecture, politics, and social expectations affected theatre productions. Students will engage in group investigative research and reporting as well as individual study. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Spring; Prerequisites: UN 1002 or UN 1003

FA 3820 American Theatre Comprehensive history of theatre in the United States from 1700 to the present. Emphasizes the socioeconomic, political, religious, and scientific forces that brought about radical change in the theatre and its role as a foreunner of the arts in mirroring American society. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Fall Spring; Prerequisites: UN 1002 or UN 1003 or permission of instructor

FA 3830 American Musical Theatre A multimedia examination of the development of American musical theatre from the late 1800s to the present, showing how this native theatrical form grew and how it mirrored the society of its time. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Spring; Prerequisites: UN 1002 or UN 1003

FA 3840 Myth and World Theatre Examines selected cultures by investigating cultural myth within drama and theatre performance. Covers cultural methodology, myth methodology, a selected culture's social history, the drama from each selected culture, and theatre production. Students engage in group investigative research and reporting as well as individual study. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Spring; Prerequisites: UN 1002 or UN 1003
FA 4150 Advanced Drawing Studio Advanced independent exploration and experimentation in drawing theory and use of various drawing media. Students identify a problem or area of interest and develop an approach to it in close consultation with a faculty member, experimenting with a variety of media and methods. Credits: variable to 6.0; repeatable to a max of 6 Lec-Rec-Lab: (0-0-0) Semesters Offered: Fall

FA 4200 Advanced Watermedia Studio Advanced work in watermedia painting. Reading and theory as well as advanced applications of personal expression in watermedia may be included. Emphasis on independence in approach to materials, techniques, and concepts. Credits: variable to 6.0; repeatable to a max of 6 Lec-Rec-Lab: (0-0-0) Semesters Offered: Fall Spring Restrictions: Permission of instructor required

FA 4250 Advanced Oil Painting Studio Advanced independent exploration and experimentation in oil painting theory and practice, supervised by a fine arts faculty member. Credits: variable to 6.0; repeatable to a max of 6 Lec-Rec-Lab: (0-0-0) Semesters Offered: Fall Spring Restrictions: Permission of instructor required

FA 4300 Advanced Sculpture Studio Projects course in advanced three-dimensional design. Requires a written proposal indicating the nature of the project, theory supporting it, and source and availability of materials, equipment, and funds to facilitate its completion. Completed project is presented to the instructor with a written justification and all drawings and models. Credits: variable to 6.0; repeatable to a max of 6 Lec-Rec-Lab: (0-0-0) Semesters Offered: Fall Spring Restrictions: Permission of instructor required

FA 4400 Chamber Music Seminar For students interested in the study and performance of instrumental chamber music. Small ensembles meet once each week for coaching, presentations, and discussion on literature and techniques of rehearsal and performance. Credits: 1.0; repeatable to a max of 6 Lec-Rec-Lab: (0-1-0) Semesters Offered: Fall Spring

FA 4420 Music Performance: Jazz Jazz combos (e.g., Jaztec, Salsa Norte) are select small jazz ensemble. Focuses on developing individual improvisational techniques, personal style, and unique original arrangements. Repertoire includes swing, jazz-rock, ballads, fusion, and experimental techniques. Activities can include performances and tours. Credits: variable to 3.0; repeatable to a max of 6 Lec-Rec-Lab: (0-0-0) Semesters Offered: Fall Spring Restrictions: Permission of instructor required

FA 4900 Independent Study: Research Independent research directed by fine arts faculty. Projects focus on one or more of the fine arts genres (theatre, music, visual arts). Requires a written proposal setting out goals, plans for final project (e.g., research paper, research Web site), and the resources required to complete the project. Credits: variable to 6.0; repeatable to a max of 6 Lec-Rec-Lab: (0-0-0) Semesters Offered: Fall Spring Restrictions: Permission of instructor required

FA 4910 Independent Study: Studio Guided independent study directed by fine arts faculty member(s) involving creating and performing new work in the areas of music, theatre, and visual arts. Requires a written proposal setting out goals, plans for final project, and the resources required to complete the project. Credits: variable to 6.0; repeatable to a max of 6 Lec-Rec-Lab: (0-0-0) Semesters Offered: On Demand Restrictions: Permission of instructor required

FA 4950 Special Topics in Fine Arts Tutorial, seminar, or class study of a topic of special interest and importance in fine arts. Credits: variable to 6.0; repeatable to a max of 6 Lec-Rec-Lab: (0-0-0) Semesters Offered: On Demand Restrictions: Permission of instructor required

FA 4960 Special Topics Workshop Special workshop projects in the fine arts. Credits: variable to 6.0; repeatable to a max of 6 Lec-Rec-Lab: (0-0-0) Semesters Offered: On Demand Restrictions: Permission of instructor required

Forestry Wood Products (FW)

FW 1035 Wood Anatomy and Properties An introduction to the micro- and macro-anatomy of wood, how wood structure is related to its function in the tree, wood quality, physical properties, and its utilization as an industrial raw material. Credits: 4.0 Lec-Rec-Lab: (3-0-3) Semesters Offered: Spring

FW 1050 Natural Resources Seminar Seminar introduces students to the various employment opportunities that represent specialties within natural resources. Extensive use of guest speakers. Credits: 1.0 Lec-Rec-Lab: (1-0-0) Semesters Offered: Spring

FW 2010 Vegetation of North America Identification of trees, shrubs, and herbaceous species. Study of seed dispersal, dormancy, seedling requirements, shade-tolerance, life span, and ecology, with an emphasis on trees. Systematic study of the major vegetation types of North America, with an introduction to other important forests of the world. Credits: 4.0 Lec-Rec-Lab: (2-1-3) Semesters Offered: Fall

FW 2046 Wood Physics The physical properties of wood as they relate to wood utilization. Specifically includes the relationship between wood and water, and wood's thermal, electrical, and mass conductive properties. Credits: 3.0 Lec-Rec-Lab: (2-0-3) Semesters Offered: Fall Restrictions: FW 1050

FW 2050 Measuring Forest Resources Introduction to the basic techniques for measuring and evaluating forest land. Includes land measurement, mapping and map use, tree measurement, estimation of volumes and values of trees and other resources, use of basic statistical measures, and introduction to growth prediction. Credits: 3.0 Lec-Rec-Lab: (2-0-4) Semesters Offered: Fall

FW 2052 Wood Mechanics Covers concepts related to the influence of wood mechanical properties on the structural uses of wood products. Explores the effects of wood anatomy on mechanical properties and failure. Credits: 4.0 Lec-Rec-Lab: (3-0-3) Semesters Offered: Spring Restrictions: PH 1110 and FW 1035 or permission of instructor

FW 2080 Introduction to Plant Biotechnology Introduction to basic concepts and practical applications of plant biotechnology with an emphasis on forest and wood products industry-related applications. Use of biotechnological approaches to resolve problems related to wood quality, biomass production, and environmental stresses of forest trees. Discusses successful cases, potential applications, and problems. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Spring

FW 2098 Mill Tour and Seminar A one-week tour of wood products manufacturing plants in the upper Midwest during the week prior to the fall semester. Each student presents a seminar on an assigned plant. Credits: 2.0 Lec-Rec-Lab: (1-0-3) Semesters Offered: Fall Restrictions: FW 1035

FW 3010 Practice of Silviculture Methods of controlling the establishment, development, and vigor of forests through the application of management techniques based on ecological and economic principles. Credits: 3.0 Lec-Rec-Lab: (2-0-4) Semesters Offered: Fall Spring Restrictions: FW 2010 and FW 2050

FW 3020 Forest and Landscape Ecology Gain a basic understanding of how environmental factors influence ecosystem function across various temporal and spatial scales. Emphasizes real-world problems and the skills necessary to resolve land-use conflicts and to manage terrestrial ecosystems. Credits: 3.0 Lec-Rec-Lab: (2-0-3) Semesters Offered: Fall Restrictions: FW 2010 and (BL 1040 or BL 2160)

FW 3067 Composite Materials I Covers concepts related to physical and chemical principles of wood adhesion, including wood adhesives, and manufacturing principles, properties, and applications of veneer and plywood. Credits: 3.0 Lec-Rec-Lab: (2-0-3) Semesters Offered: Fall Restrictions: FW 2046 and FW 2052

FW 3068 Composite Materials II Manufacturing principles, properties, and applications as related to particleboard, fiberboard, medium density fiberboard, and oriented strandboard (OSB). Discusses new wood-based composite developments. Credits: 4.0 Lec-Rec-Lab: (3-0-3) Semesters Offered: Spring Restrictions: FW 3067

FW 3077 Wood Chemistry and Pulping Processes Chemical properties of wood cellulose, hemicelluloses, and lignin. Chemistry and mechanisms in chemical pulping and bleaching processes. Credits: 4.0 Lec-Rec-Lab: (3-0-3) Semesters Offered: Fall Restrictions: CH 2400C or CH 2410C or permission of instructor

FW 3110 Natural Resource Policy Covers concepts related to social systems and natural resources. Offers a survey of natural resource policies and organizations. State and federal levels of policy making will be linked to the human values, attitudes, and beliefs that set the context for natural resource policy processes. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Spring Restrictions: UN 2002(C) or permission of instructor

FW 3150 Timber Harvesting Methods and techniques used in timber harvesting systems. Emphasizes best management practices and efficient allocation of resources in logging. Credits: 1.0 Lec-Rec-Lab: (0-1-3) Semesters Offered: Fall Restrictions: FW 2050 or permission of instructor

FW 3170 Land Measurements and GPS Basic field measurements and computations involved in determining direction, distance, and area. Covers the hand compass, pacing, and use of global positioning systems, including differential correction. Explores use of GIS in map generation. Credits: 2.0 Lec-Rec-Lab: (1-0-3) Semesters Offered: Fall Corequisites: FW 3190

FW 3190 Multiresource Assessment Develops a basic proficiency in the application of multiple-resource measurement techniques. Gain familiarity with the application of individual tree and landscape measurements as well as estimation of growth, sampling techniques, computational procedures, and mapping procedures commonly used in forest and land management. Credits: 4.0 Lec-Rec-Lab: (3-0-3) Semesters Offered: Fall Corequisites: FW 3010, FW 3170 Restrictions: FW 2050 and FW 3020 and MA 2270

FW 3330 Soil Science Introduction to the chemical, physical, and biological properties of soils and how properties affect the soil hydrologic cycle. Credits: 4.0 Lec-Rec-Lab: (3-0-4) Semesters Offered: Fall Restrictions: CH 1100C or permission of instructor

FW 3360 Computer Applications in Natural Resource Management Covers computer hardware, software, and their interrelationship; operating systems and computer networks; software and algorithms required for the analysis and communication of natural resource data. Software covered includes commercial packages for word processing, spreadsheets, statistical analysis, and elementary map drawing. Credits: 3.0 Lec-Rec-Lab: (2-0-3) Semesters Offered: Fall Corequisites: FW 2050
FW 3410 Conservation Biology
Introduction to biological, social, political, and economic facets of conservation biology. Emphasizes evaluation of how best to maintain and restore biodiversity through management of populations and ecosystems. Topics include mass extinctions, global change, loss and degradation of habitat, and over exploitation of biologically important resources. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semester Offered: Spring Prerequisites: UN 2002 or permission of instructor

FW 3540 Remote Sensing and Geographic Information Systems for Natural Resource Management
The theory and application of remote sensing and geographic information systems (GIS) technologies to resource management. Teaches manual and digital interpretation techniques using aerial photography and satellite imagery. Includes photogrammetric principles and measurements. Discusses the use of ancillary data, ground truthing, and accuracy assessment. Credits: 4.0 Lec-Rec-Lab: (2-1-3) Semester Offered: Spring Prerequisites: MA 2720(C)

FW 3600 Wildlife Habitat
Understand the ecological basis for management of forest wildlife and how forest management influences wildlife populations. Laboratory introduces techniques in wildlife research and management, especially methods of habitat analysis. Credits: 3.0 Lec-Rec-Lab: (2-0-3) Semester Offered: Fall Restrictions: Must be enrolled in one of the following Class(es): Junior Senior

FW 3610 Ornithology
An ecological and evolutionary approach to the study of birds. Topics include behavioral, anatomical, and physiological adaptations to flight, life history, mating systems, migration, communication and conservation. Laboratory emphasizes identification and experimental use of birds as model organisms. Credits: 4.0 Lec-Rec-Lab: (3-0-3) Semester Offered: Spring Prerequisites: BL 2160 or BL 2170 or permission of instructor

FW 3620 Field Ornithology
An introduction to field techniques and identification. Weekend trip to Whitefish Point Bird Observatory during spring migration and field note taking. Credits: 1.0 Lec-Rec-Lab: (0-1-0) Semester Offered: Spring

FW 3760/SS 3760 Human Dimensions of Natural Resources
Uses sociological concepts to cover facets of human relationships to natural resources, including human values, beliefs, and attitudes regarding the environment; rural resource-dependent communities; natural resource professions and expert knowledge; and the history of American perspectives on the environment. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semester Offered: Fall Prerequisites: UN 2002

FW 3900 Conservation Biology and Ecology in Veracruz
Study the diverse ecosystems of Veracruz State, Mexico. Includes wetlands, moist tropical forests, deserts, pine-oak, tropical alpine, and Mexican agroecosystems. Course includes three-day field trips. Taught in Veracruz, Mexico (English language). Credits: 5.0 Lec-Rec-Lab: (0-7-8) Semester Offered: Spring Prerequisites: UN 2002

FW 3910 Mushrooms of Veracruz
Fundamentals of mycology taught in Veracruz State, Mexico. Field applications of mycology: rusts on crops; production of mushrooms for community use and commercial production in a sustainable manner; role of fungi in Mexican ecosystems, farm systems, and culture. Impact of development on rural Mexico. Taught in Veracruz, Mexico (English language). Credits: 5.0 Lec-Rec-Lab: (3-0-8) Semester Offered: Spring Prerequisites: UN 2002

FW 4024 Wood Preservation and Drying
Studies microorganisms, insects, and other biological agents that can cause deterioration of wood-in-use. Covers the chemistry and nature of wood preservative systems and the manufacture of treated wood products. Discusses principles and methods of wood drying, drying defects, and commercial practices. Credits: 3.0 Lec-Rec-Lab: (2-0-3) Semester Offered: Spring Prerequisites: FW 1035 and FW 2046

FW 4030 Spring Field Techniques and Identification
Introduction to field techniques and identification. Weekend trip to Whitefish Point Bird Observatory during spring migration and field note taking. Credits: 1.0 Lec-Rec-Lab: (0-1-0) Semester Offered: Spring

FW 4040 Forest Economics and Finance
Financial analysis and economic theory applied to forest project analysis and selection, focusing on prices. Covers risk, regional economics, taxation, auctions, and non-market valuation. Uses operations research and statistical methods to solve problems. Credits: 4.0 Lec-Rec-Lab: (3-0-2) Semester Offered: Spring Restrictions: Must be enrolled in one of the following Class(es): Junior Senior Prerequisites: MA 2720

FW 4085 Wood Biotechnology
Biotechnological applications in the forest and wood products industry. Includes genetic control of wood quality and wood durability, lignin and cellulose biosynthesis, growth and development, environmental stress tolerance, secondary metabolism, and phenotyping. In-depth study of the regulatory mechanisms and strategies applied in the genetic manipulation of desired traits. Credits: 3.0 Lec-Rec-Lab: (2-1-0) Semester Offered: Fall Restrictions: Must be enrolled in one of the following Class(es): Senior Prerequisites: FW 2089

FW 4087 Molecular Genetics of Trees
Covers tree genealogy, structure, and function relationship of genes from trees; genome mapping using various techniques, such as AFLP, RAPD, AFLP and ESTs; GeneChip and Microarray applications; and DNA finger printing. Learn marker-assisted selection and gene tagging for qualitative and quantitative traits as well as physical mapping and map-based cloning of important genes. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semester Offered: Spring Restrictions: Must be enrolled in one of the following Class(es): Senior

FW 4089 Plant Bioinformatics
Computer applications in molecular biology. Hands-on experience with popular computer programs for DNA, RNA, and protein sequence analysis. Learn database management, data editing, assembly, and organization. Covers multiple-sequence comparisons, protein structural analysis, evolutionary relationships of genes, and use of internet for data retrieval, comparison, and analysis. Credits: 3.0 Lec-Rec-Lab: (1-0-2) Semester Offered: Spring Restrictions: Must be enrolled in one of the following Class(es): Senior

FW 4110 Tree Seedling Production and Greenhouse Management
Demonstrates greenhouse culture of trees from seed or vegetative cuttings. Topics include production of containerized seedlings; vegetative propagation via budding, grafting, and rooting of cuttings; and genetic manipulation. Students have hands-on roles in the routine greenhouse work, such as media preparation, pest management, and fertilization. Credits: variable to 4.0 Lec-Rec-Lab: (0-0-0) Semester Offered: Spring Restrictions: Must be enrolled in one of the following Class(es): Junior Senior

FW 4120 Tree Physiology and Genetics
Introduction to the genetics and physiology of forest trees. Develops a basic understanding of how trees grow and develop and why they vary from tree to tree. Covers modern methods to improve forest trees. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semester Offered: Spring

FW 4140 Ecosystem Modeling
Introduces the principles of quantitative analysis of ecosystem, population models, and growth-yield. Emphasizes modeling philosophy, approaches (e.g., empirical models), and applications in understanding changes of forest ecosystems and alternatives in management (e.g., landscape management system, LMS). Credits: 3.0 Lec-Rec-Lab: (2-0-3) Semester Offered: Spring Restrictions: Must be enrolled in one of the following Class(es): Junior Senior Prerequisites: MA 1135 and MA 2720

FW 4150 Forest Management
Methods of organizing forest properties for sustainability and multiple-use management using operations research methods, particularly linear programming, for selecting preferred options. Emphasizes developing an understanding of the strengths and weaknesses of the models used. Discusses single- and multiple-use land management formulations. Credits: 3.0 Lec-Rec-Lab: (2-0-3) Semester Offered: Spring Prerequisites: FW 3010 and FW 4080 and FW 4140 or permission of instructor

FW 4220 Wetlands
Study of the physical, chemical, and biological characteristics of wetlands. Describes functions and values of individual wetland types. Presents management of wetlands and laws governing wetlands. Labs concentrate on field techniques used to assess specific plant, animal, soil, and hydrological characteristics of wetlands. Credits: 4.0 Lec-Rec-Lab: (3-0-3) Semester Offered: Fall Prerequisites: UN 2002

FW 4240 Mammalogy
Covers the classification, structure, and natural history of mammals, including physiological, behavioral, and ecological adaptations. Through laboratory and fieldwork, emphasizes field techniques and the distribution and identification of mammals, especially those species found in the western Great Lakes. Credits: 4.0 Lec-Rec-Lab: (3-0-3) Semester Offered: Fall; offered alternate years beginning with the 2000-01 academic year Restrictions: Must be enrolled in one of the following Class(es): Junior Senior Prerequisites: BL 1040

FW 4300 Forest Fire Ecology and Management
Principles of forest fire management based on an understanding of fire behavior, with special emphasis on ecological effects. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semester Offered: Spring; offered alternate years beginning with the 2000-01 academic year Prerequisites: FW 3010 and FW 3020 or permission of instructor

FW 4360 Forest Soils and Watershed Management
Principles of forest soil and watershed management based on an understanding of soil chemical, physical, and biological properties, and forest management practices. Credits: 4.0 Lec-Rec-Lab: (3-1-0) Semester Offered: Spring; offered alternate years beginning with the 2001-02 academic year Prerequisites: FW 3330 and FW 3010 or permission of instructor

FW 4400 Urban Forestry
Urban forestry covers the planting and maintenance of trees in urban settings. Presents modern arboriculture and tree care methods and discusses administration of urban forests. Topics covered include pest management, pruning, planting, fertilization, inventories, tree selection, and tree care. Labs include experience in tree climbing, pruning, and planting. Credits: 3.0 Lec-Rec-Lab: (2-0-3) Semester Offered: Spring

FW 4500 Independent Study
Guided study or research on an approved forest resource topic with a chosen faculty member. Credits: variable to 7.0; repeatable to a max of 1 Lec-Rec-Lab: (0-0-0) Semester Offered: Fall Spring Summer Restrictions: Permission of instructor required

FW 4520 Tropical Forests
Ecology, traditional use, current problems, and potential solutions to those problems in various types of tropical forests. Includes a broad understanding of the social and political dynamics of countries where the forests are located. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semester Offered: Fall; offered alternate years beginning with the 2001-2002 academic year Restrictions: Must be enrolled in one of the following Class(es): Junior Senior Prerequisites: BL 3400(C) or permission of instructor

FW 4610 Wildlife Ecology
Covers the ecological basis for management of wildlife, including biological and sociological factors that influence management. Credits: 3.0 Lec-Rec-Lab: (3-0-1) Semester Offered: Fall; offered alternate years beginning with the 2001-2002 academic year Restrictions: Must be enrolled in one of the following Class(es): Junior Senior Prerequisites: BL 3400(C) or permission of instructor

FW 5070 Isle Royale Field Ecology Camp
An intensive field-based course in research methods. Introduces the process of ecological science, from initial questions to devising methods to collect data to assessing the strength of conclusions drawn from the results. Course takes place on Isle Royale and nearby mainland habitats. Credits: 6.0 Lec-Rec-Lab: (0-6-0) Semester Offered: Summer Restrictions: Must be enrolled in one of the following Class(es): Junior Senior

FW 4700 Diseases and Insects of Forest Ecosystems
Recognition, ecology, and
management of important forest tree diseases and insects, and deterioration of forest products. Emphasizes human activity, importance in ecosystem function, and forest resources. Using diseases and pests of North America as examples, develops the principles of tree and forest disease and insect diagnosis, identification, and controls. Credits: 3.0 Lec-Rec-Lab: (2-0-3) Semesters Offered: Fall Prerequisites: FW 3020(C) and FW 1035(C) or permission of instructor

FW 4810 Integrated Resource Assessment First of two courses on integrated resource management to form a capstone experience. Covers multisource inventory of forested landscapes; description and evaluation of the potential for providing various natural resource outputs; and development of GIS applications, maps, and other descriptors useful in the analysis of diverse management alternatives. Credits: 3.0 Lec-Rec-Lab: (2-0-3) Semesters Offered: Fall Prerequisites: FW 4140 and FW 3540 and FW 3020 and (FW 3190 or FW 3410)

FW 4820 Integrated Resource Management Second of two courses on resource assessment for a parcel of land. Students continue to assess natural resources on a parcel of land and develop a range of management alternatives for their parcel. They will also develop efficient land allocations in response to each alternative and evaluate landscape-level implications. Credits: 3.0 Lec-Rec-Lab: (2-3-3) Semesters Offered: Spring Prerequisites: FW 4810

Geological Eng/Geology/Geophysics (GE)

GE 2000 Understanding the Earth Introduction to materials and processes that shape the earth we live on. Lecture and laboratories acquaint students with minerals, rocks, earth resources, weathering, geologic time, landforms, groundwater, streams, coastlines, deserts, glaciers, geologic structures, earthquakes, plate tectonics, and the dynamic of the earth's crust, mantle, and core. Credits: 3.0 Lec-Rec-Lab: (2-0-3) Semesters Offered: Fall

GE 2050 Understanding Minerals Introduction to the properties, identification, origin, and importance of minerals. GE2000 or equivalent is recommended. Credits: 3.0 Lec-Rec-Lab: (2-0-3) Semesters Offered: On Demand Restrictions: May not be enrolled in one of the following Major(s): Geological Engineering, Geology, Geophysics

GE 2100 Environmental Geology Introduction and study of current environmental issues related to the earth sciences. Covers major topics such as volcanism, earthquakes, shoreline erosion, and pollution of groundwater as multi-week modules with associated labs, lectures, and field projects. Credits: 3.0 Lec-Rec-Lab: (2-0-3) Semesters Offered: Spring

GE 2200 Earth Systems Introduction for geoscience majors to the large- and small-scale processes at work in shaping our planet. Topics include the tectonic and geophysical evolution of continents and oceans, and the geomorphological processes that affect rivers, lakes, coasts, landscapes, and the atmosphere. Not open to students who have credit for GE2000. Credits: 4.0 Lec-Rec-Lab: (3-0-2) Semesters Offered: Fall Restrictions: Must be enrolled in one of the following Major(s): Applied Geophysics, Engineering-Geoenvironmental, Geological Engineering, Geophysics

GE 2300 Earth Materials I: Mineralogy Identification, physical properties, chemistries, structures, uses, and occurrences of minerals. Includes the application of x-ray diffractometry to mineral identification and an introduction to the optical properties of minerals. Credits: 3.0 Lec-Rec-Lab: (2-0-3) Semesters Offered: Fall

GE 2310 Earth Materials II: Rocks and Mineral Resources Identification, physical properties, chemical composition, occurrence, and origin of the important types of igneous, sedimentary, and metamorphic rocks. Includes the geological setting and origin of the major types of mineral resources. Laboratory includes description and identification of rocks and mineral resources. GE2300 recommended. Credits: 3.0 Lec-Rec-Lab: (3-0-3) Semesters Offered: Spring Prerequisites: GE 2000 or GE 2200

GE 2400 Introduction to Applied and Environmental Geophysics Introduction to geophysical methods used in applied and environmental geophysics with emphasis on data reduction and interpretation. Pertinent not only for the practicing geoscientist, but also for environmental engineers, civil engineers, and others interested in learning how physics can be used to investigate earth's subsurface. Credits: 4.0 Lec-Rec-Lab: (3-0-2) Semesters Offered: Spring Prerequisites: PH 2200

GE 2640/PH 2640 Introduction to Meteorology Introduction to the fundamentals of meteorology and atmospheric science, including atmospheric composition and structure, atmospheric thermodynamics, radiative transfer, atmospheric fluid dynamics, and cloud physics. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Fall; offered alternate years beginning with the 2000–01 academic year

GE 2900 Geology of Utah's National Parks Two-week, field-based course taught in the national parks and monuments of eastern Utah. Focuses on making and recording observations, developing and testing hypotheses, integrating information from a variety of sources, and presenting results in a variety of formats. Credits: 3.0 Lec-Rec-Lab: (3-0-3) Semesters Offered: On Demand

GE 3000 Structural Geology Rock structures resulting from the application of deforming forces, including elementary concepts of stress and strain, the geometry and origin of folds, foliations, lineations, faults, and joints, the mechanics of folding and faulting, and structures in orogenic belts. Credits: 3.0 Lec-Rec-Lab: (3-0-2) Semesters Offered: Fall Prerequisites: GE 2000 or GE 2200

GE 3100 Depositional Systems Introduction to sedimentary processes and their products. Investigates the physical processes controlling sedimentation along with principles of correlation and interpretation of strata. Focuses on interpreting sedimentary rocks as a record of climate, sea-level and tectonic change. Credits: 4.0 Lec-Rec-Lab: (2-0-3) Semesters Offered: Fall Prerequisites: (GE 2000 or GE 2200) and GE 2310

GE 3150 Petroleum Geology Introduction to elements of petroleum geology. Covers concepts and techniques unique to the petroleum industry. Provides students with tools to work in an introductory capacity in the energy industry. Labs are computer-oriented. Credits: 3.0 Lec-Rec-Lab: (2-0-3) Semesters Offered: Spring Prerequisites: (GE 2000 or GE 2200) and GE 2110

GE 3200 Geochemistry Introduction to elements of modern geochemistry including aqueous solutions, isotopes, age dating, etc. Emphasizes concepts and quantitative methods. Teaches principles of thermodynamics and phase equilibria from an introductory perspective as they pertain to geologic systems. Credits: 3.0 Lec-Rec-Lab: (2-1-0) Semesters Offered: Spring Prerequisites: CH 1100 or CH 1110

GE 3300 Introduction to Oceanography Effect of waves, tides, currents, natural hazards along shorelines, and air-sea interactions on the climate. Credits: 3.0 Lec-Rec-Lab: (2-0-3) Semesters Offered: Spring

GE 3320 Earth History and Paleoclimatology What does the earth's past tell us about global climate change on a geologic time scale? Overview of the origin and history of the earth. Emphasizes the geologic history of North America. Includes evidence for past climate changes and the response of earth systems to those changes. Credits: 3.0 Lec-Rec-Lab: (2-0-3) Semesters Offered: Spring Prerequisites: GE 2000 or GE 2200 or GE 2400

GE 3600/MY 3600 Sampling and Data Analysis Fundamentals of physical sampling of large lots of materials, design of experiments, and statistical analysis. Credits: 3.0 Lec-Rec-Lab: (2-0-3) Semesters Offered: Spring

GE 3800 Earth Mechanics Students learn the fundamentals of solid and fluid mechanics as applied to geologic and environmental systems. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Fall Prerequisites: MEEM 2120 and PH 2200

GE 3830 Geohydrology Geologic and hydrologic factors controlling the occurrence, movement, and development of subsurface water. Quantitative methods for analyzing groundwater systems are introduced. GE3800 or equivalent recommended. Credits: 3.0 Lec-Rec-Lab: (2-0-3) Semesters Offered: Spring

GE 3900 Field Geophysics Introduction to field geophysical techniques including basic land surveying. Emphasizes the recording, reduction, presentation, and interpretation of gravity, magnetic, electrical, seismic, and electromagnetic data as well as the proper use, care, and calibration of equipment used to collect the data. Requires report writing. Students must provide their own transportation. Credits: 5.0 Lec-Rec-Lab: (0-0-5) Semesters Offered: Summer Prerequisites: GE 2400

GE 3910 Field Geology with Engineering Applications Introduction to methods and problems of field geology, interpretation of field relationships, and engineering site investigation. Field areas are located in northern Michigan. Requires geologic and/or engineering report and memo writing. Credits: 5.0 Lec-Rec-Lab: (0-0-5) Semesters Offered: Summer Prerequisites: GE 2000 or GE 2200 and GE 2310 and GE 3000

GE 3915 Introduction to Field Geology An introduction to geologic field mapping and site investigations. Requires geologic and/or engineering report and memo writing. Credits: 3.0 Lec-Rec-Lab: (0-0-5) Semesters Offered: On Demand Restrictions: May not be enrolled in one of the following Major(s): Applied Geophysics, Geological Engineering, Geophysics Prerequisites: GE 2000 or GE 2100 or GE 2200

GE 3920 Geological Field Excursion A geological field excursion of one week or more to areas of outstanding interest to geologists. Credits: variable to 6.0; repeatable to a maximum of 6 Lec-Rec-Lab: (0-0-0) Semesters Offered: On Demand

GE 4000 Earth Science Teaching Experience Development of earth science teaching skills through assisting in instruction in a geology course laboratory. Students gain experience in organizing, preparing, and presenting earth science topics and answering questions. Credits: variable to 3.0; repeatable to a maximum of 3 Lec-Rec-Lab: (0-0-0) Semesters Offered: On Demand

GE 4050 Advanced Structural Geology How rocks deform on a microstructural to hand specimen scale. Topics include dislocations, work hardening and recovery processes, annealing and recrystallization, slip systems, preferred orientation mechanisms, and foliation development. Credits: 3.0 Lec-Rec-Lab: (2-0-3) Semesters Offered: On Demand Prerequisites: GE 3000

GE 4100 Geomorphology and Glacial Geology The study of the processes, including fluvial, glacial, wind, mass movement, and wave action, shaping the earth's surface by erosion and deposition of geologic materials. Emphasizes the role of past and present climate. Field trips are a major component. Credits: 4.0 Lec-Rec-Lab: (3-0-3) Semesters Offered: Fall Restrictions: Must be enrolled in one of the following Class(es): Junior Senior Prerequisites: GE 2000 or GE 2200

GE 4150 Natural Hazards Exploration of how to develop comprehensive plans to mitigate the impact of natural hazards on humans. Includes basic scientific background, current mitigation practices, and proposed mitigation strategies. Includes group and individual student proposals for value added. Most recent natural disasters will be focal points. Credits: 3.0 Lec-Rec-Lab: (2-0-3) Semesters Offered: Fall; offered alternate years beginning with the 2001-02 academic year Restrictions: Must be enrolled in one of the following Classes): Junior Senior Prerequisites: (GE 2000 or GE 2100 or GE 2200) and UN 2002

GE 4160 Introduction to Subsurface GIS Introduction to elements of GIS, emphasizing
application to subsurface from groundwater levels to gas and oil reservoirs. Students prepare maps of subsurface features using large data sets. Labs use current, popular GIS software packages. Credits: 3.0 Lec-Rec-Lab: (2-0-3) Semesters Offered: On Demand

GE 4170 Volcanic Clouds  Remote sensing applied to volcanic cloud hazards. Credits: 4.0; repeatable to a max of 8 Lec-Rec-Lab: (2-0-6) Semesters Offered: On Demand Restrictions: Must be enrolled in one of the following Class(es): Senior

GE 4200 Applied Geochemistry  Monitoring techniques, collection of field data, processing, and analysis of geochemical data to study near-surface environmental systems. Credits: 3.0 Lec-Rec-Lab: (2-0-3) Semesters Offered: Fall; offered alternate years beginning with the 2000-01 academic year Prerequisites: GE 3200

GE 4300 Igneous and Metamorphic Petrology  Optical mineralogy taught first five weeks. Petrogenesis of igneous and metamorphic rocks, including petrographic imagery and quantitative microdescriptive techniques. Credits: 4.0 Lec-Rec-Lab: (2-2-3) Semesters Offered: On Demand Prerequisites: GE 2300 and GE 2310

GE 4400 Near Surface Geophysics I  Design of geophysical site investigations utilizing resistivity, electromagnetic, ground penetrating radar, and magnetic techniques. Emphasizes geophysical detection of contamination, ground water supplies, and mining applications. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Fall Prerequisites: GE 2400 and PH 2200

GE 4410 Near Surface Geophysics II  Principles and design of geophysical investigations of the shallow subsurface. Emphasizes seismic refraction and reflection methods with focus on engineering and groundwater applications. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Spring Prerequisites: GE 2400 and PH 2200

GE 4500 Plate Tectonics and Global Geophysics  Plate tectonics and the internal structure of the earth using information from seismology, geodynamics, gravity, and heat flow. Credits: 3.0 Lec-Rec-Lab: (2-0-3) Semesters Offered: Fall Prerequisites: MA 3150 and PH 2200 and (GE 2000 or GE 2200)

GE 4600 Reflection Seismology  Principles of reflection seismic techniques, including theoretical background and application, and hands-on computer projects. Included are acquisition, data processing, and 2D/3D data interpretation. Students conduct projects using actual commercial-quality seismic data. Credits: 3.0 Lec-Rec-Lab: (2-1-0) Semesters Offered: Fall Prerequisites: GE 2400 and GE 3000

GE 4610 Formation Evaluation and Petroleum Engineering  Principles and practice of formation evaluation, primarily through analysis of well logs and the principles and practice of petroleum engineering. Emphasizes reservoir engineering and simulation. Students conduct projects using actual field data. A three-day field trip is required. Credits: 3.0 Lec-Rec-Lab: (2-1-0) Semesters Offered: Spring Prerequisites: GE 2400 and GE 3150(C)

GE 4640/PH 4640 Meteorology  Essential elements of atmospheric physics and meteorology, including atmospheric composition and structure, atmospheric thermodynamics, radiative transfer, atmospheric fluid dynamics, and cloud physics. In addition to prerequisites, PH2300 and MA4515 are recommended. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Fall; offered alternate years beginning with the 2001-02 academic year Prerequisites: (PH 2200 or PH 2200H and (MA 3150 or MA 3160) and (MA 3520 or MA 3530) or permission of instructor

GE 4750 Structural Styles in Petroleum Engineering  Geometry and mechanics of extensional, wrench and compressional features that produce structural traps in petroleum engineering, including techniques of subsurface geological mapping. Credits: 3.0 Lec-Rec-Lab: (2-0-2) Semesters Offered: Spring Prerequisites: GE 3000

GE 4760 Engineering Evaluation of Mineral Deposits  Design of programs to explore and evaluate various types of mineral deposits. An integrated project includes factors such as geologic characteristics, economics, regulations, and environmental impact. Credits: 3.0 Lec-Rec-Lab: (2-0-3) Semesters Offered: Spring Prerequisites: GE 2310 and GE 3000

GE 4800 Groundwater Engineering  Application of hydrogeology principles to design groundwater supply, protection, and treatment systems for municipal and agricultural uses. Credits: 3.0 Lec-Rec-Lab: (2-0-3) Semesters Offered: On Demand Prerequisites: GE 3800 and GE 3850

GE 4810 Groundwater Site Investigation  Geologic factors affecting site investigations, investigative techniques and methods, and reports of investigation. Emphasizes quantitative techniques and methods for investigating groundwater resources and quality. Credits: 3.0 Lec-Rec-Lab: (2-0-3) Semesters Offered: On Demand Prerequisites: GE 3850

GE 4820 Subsurface Remediation  Covers the scientific and engineering principles of in-situ subsurface remediation. Topics include subsurface fate and transport processes, remediation site characterization, remediation process design, and related policy issues. Credits: 3.0 Lec-Rec-Lab: (2-0-3) Semesters Offered: On Demand Restrictions: Must be enrolled in one of the following Class(es) Senior Prerequisites: GE 3850

GE 4900 Geological Engineering Design Project I  Capstone geological engineering design course focusing on a realistic, complex, open-ended geological engineering problem. Project includes technical design, economic analysis, environmental impacts, and regulations. Report writing required. Credits: 3.0 Lec-Rec-Lab: (3-0-3) Semesters Offered: Fall Restrictions: Must be enrolled in one of the following Class(es): Senior Prerequisites: GE 4900

GE 4910 Geological Engineering Design Project II  Continuation of GE4900. Capstone geological engineering design course focusing on a realistic, complex, open-ended geological engineering problem. Project includes technical design, economic analysis, environmental impacts, and regulations. Report writing required. Credits: 3.0 Lec-Rec-Lab: (3-0-3) Semesters Offered: Spring Restrictions: Must be enrolled in one of the following Class(es): Senior Prerequisites: GE 4900

GE 4920 Geological Engineering Seminar  Seminar course dealing with geological engineering subjects of current interest. Credits: 3.0; repeatable to a max of 9 Lec-Rec-Lab: (0-3-0) Semesters Offered: On Demand Restrictions: Must be enrolled in one of the following Class(es): Senior

GE 4921 Geology Seminar  Seminar course dealing with geology subjects of current interest. Credits: 3.0; repeatable to a max of 9 Lec-Rec-Lab: (0-3-0) Semesters Offered: On Demand Restrictions: Must be enrolled in one of the following Class(es): Senior

GE 4922 Geophysics Seminar  Seminar course dealing with geophysics subjects of current interest. Credits: 3.0; repeatable to a max of 9 Lec-Rec-Lab: (0-3-0) Semesters Offered: On Demand Restrictions: Must be enrolled in one of the following Class(es): Senior

GE 4930 Special Topics in Geological Engineering  Study and discussion of geological engineering topics. Credits: variable to 3.0; repeatable to a max of 9 Lec-Rec-Lab: (0-0-0) Semesters Offered: On Demand Restrictions: Permission of instructor required

GE 4931 Special Topics in Geology  Study and discussion of geology topics. Credits: variable to 3.0; repeatable to a max of 9 Lec-Rec-Lab: (0-0-0) Semesters Offered: On Demand Restrictions: Permission of instructor required

GE 4932 Special Topics in Mineralogy  The study of special topics in mineralogy using the Seaman Mineral Museum. Credits: variable to 3.0; repeatable to a max of 6Lec-Rec-Lab: (0-0-0) Semesters Offered: On Demand Restrictions: Permission of instructor required Prerequisites: GE 2050 or GE 2300

GE 4933 Special Topics in Geophysics  Study and discussion of geophysics topics. Credits: variable to 3.0; repeatable to a max of 9 Lec-Rec-Lab: (0-3-0) Semesters Offered: On Demand Restrictions: Permission of instructor required

GE 4960 Independent Geological Engineering  Research Project  Approved engineering design research project originated by the student or assigned by the instructor. A final report is required. Credits: variable to 9.0; repeatable to a max of 9 Lec-Rec-Lab: (0-0-0) Semesters Offered: On Demand Restrictions: Permission of instructor required; must be enrolled in one of the following Class(es): Senior

GE 4961 Independent Geology Research  Project  Approved literature, laboratory, and/or field geology research problem originated by the student or assigned by the instructor. A final report is required. Credits: variable to 9.0; repeatable to a max of 9 Lec-Rec-Lab: (0-0-0) Semesters Offered: On Demand Restrictions: Permission of instructor required; must be enrolled in one of the following Class(es): Senior

GE 4962 Independent Geophysics Research Project  Approved literature, laboratory, and/or field geophysics research problem originated by the student or assigned by the instructor. A final report is required. Credits: variable to 9.0; repeatable to a max of 9 Lec-Rec-Lab: (0-0-0) Semesters Offered: On Demand Restrictions: Permission of instructor required; must be enrolled in one of the following Class(es): Senior

Humanities (HU)

HU 0110 Individualized Instruction in College Writing and Reading  Individualized work with a writing coach. Available to graduate and undergraduate students working on writing and reading tasks of all kinds. Specialized support available for ESL students and students with learning disabilities. Strongly recommended for all students entering with English ACT scores of 20 or below. Credits do not count toward graduation. Credits: 3.0; may be repeated; graded Pass/Fail only Lec-Rec-Lab: (0-1-0) Semesters Offered: Fall Spring Summer

HU 1011 Computer Lab Sign Up  Allows students to be billed for the humanities computer lab, the Center for Computer-assisted Language Instruction (CCLI). Credits do not count toward graduation. Credits: 1.0; may be repeated; graded Pass/Fail only Lec-Rec-Lab: (0-1-0) Semesters Offered: On Demand

HU 1211 Level I-A French Language and Culture  Introduction to basic French grammar, vocabulary, and idioms, designed to acquaint students with the minimum essentials of oral and written French. Includes discussion of various aspects of contemporary French-speaking cultures. Credits: 3.0 Lec-Rec-Lab: (3-0-3) Semesters Offered: Fall Restrictions: May not be enrolled in one of the following Classes: Senior

HU 1212 Level I-B French Language and Culture  Further study of French grammar, vocabulary, and idioms, continued practice of conversational skills, and basic readings in French. Continued discussions of French culture are supplemented by music, films, and contact with native speakers or those with advanced French-speaking skills. Credits: 3.0 Lec-Rec-Lab: (3-0-3) Semesters Offered: Spring Restrictions: May not be enrolled in one of the following Classes: Senior Prerequisites: HU 1211

HU 1213 French Intensive Summer Workshop  Intensive summer workshop in French
language and culture, stressing the development of listening comprehension, speaking, reading, and writing proficiency. Includes grammar review, pronounciation, language usage, and other communicative activities. Hours outside of class include film viewings, story hours, meetings with native speakers, and other language-intensive activities. Offered as resources allow. Credits: 3.0; repeatable to a max of 6

HU 1215
Transitional Level I
French Language and Culture Intensive study of French grammar, vocabulary, and culture. Designed to prepare students with minimum essentials of oral and written French for intermediate and advanced level work. Students completing this course may apply for advanced placement. Requires two years of high school French or permission of instructor. Credits: 3.0; 3-semesters Offered: Fall; Spring Restrictions: May not be enrolled in one of the following Classes(s): Senior

HU 1221 Level I A-German Language and Culture Introduction to basic German grammar, vocabulary, and idioms, acquainting students with the minimum essentials of oral and written German. Introduces the culture and the societies of contemporary German-speaking Europe. Credits: 3.0; 3-semesters Offered: Fall; Spring Restrictions: May not be enrolled in one of the following Classes(s): Junior Senior

HU 1222 Level I-B German Language and Culture Further study of German grammar, vocabulary, and idioms, with emphasis on conversational skills. Includes continued discussion of German culture and society. Credits: 3.0; 3-semesters Offered: Spring Restrictions: May not be enrolled in one of the following Classes(s): Senior Prerequisites: HU 1221

HU 1223 German Intensive Summer Workshop Intensive summer workshop in German language and culture, stressing the development of listening comprehension, speaking, reading, and writing proficiency. Includes grammar review, pronounciation, language usage, and other communicative activities. Hours outside of class include film viewings, story hours, meetings with native speakers, and other language-intensive activities. Offered as resources allow. Credits: 3.0; repeatable to a max of 6

HU 1225 Transitional Level I German Language and Culture Intensive study of German grammar, vocabulary, and culture. Designed to prepare students with minimum essentials of oral and written German for intermediate and advanced level work. Students completing this course may apply for advanced placement. Requires two years of high school German or permission of instructor. Credits: 3.0; 3-semesters Offered: Fall; Spring Restrictions: May not be enrolled in one of the following Classes(s): Junior Senior

HU 1231 Level I A-Spanish Language and Culture Introduction to basic Spanish grammar, vocabulary, and idioms, designed to acquaint students with the minimum essentials of oral and written Spanish. Includes discussion of various aspects of contemporary Spanish-speaking cultures. Credits: 3.0; 3-semesters Offered: Fall; Spring Restrictions: May not be enrolled in one of the following Classes(s): Senior

HU 1232 Level I-B Spanish Language and Culture Further study of Spanish grammar, vocabulary, and idioms, continued practice of conversational skills, and basic readings in Spanish. Continued discussions of Hispanic culture are supplemented by music, films, and contact with native speakers or those with advanced Spanish-speaking skills. Credits: 3.0; 3-semesters Offered: Spring Restrictions: May not be enrolled in one of the following Classes(s): Senior

HU 1233 Spanish Intensive Summer Workshop Intensive summer workshop in Spanish language and culture, stressing the development of listening comprehension, speaking, reading, and writing proficiency. Includes grammar review, pronounciation, language usage, and other communicative activities. Hours outside of class include film viewings, story hours, meetings with native speakers, and other language-intensive activities. Offered as resources allow. Credits: 3.0; repeatable to a max of 6

HU 1235 Level I-B Spanish Language and Culture Further study of Spanish grammar, vocabulary, and idioms, continued practice of conversational skills, and basic readings in Spanish. Continued discussions of Hispanic culture are supplemented by music, films, and contact with native speakers or those with advanced Spanish-speaking skills. Credits: 3.0; 3-semesters Offered: Spring Restrictions: May not be enrolled in one of the following Classes(s): Senior

HU 1241 Level I A-Less Commonly Taught Languages Introduction to basic grammar, vocabulary, and idioms, designed to acquaint students with the minimum essentials of oral and written communication. Includes discussion of various aspects of the culture of the language being taught. Languages taught may include but are not limited to Ojibwa and Japanese. Credits: 3.0; 3-semesters Offered: Fall; Spring Restrictions: May not be enrolled in one of the following Classes(s): Senior

HU 1242 Level I B-Less Commonly Taught Languages Further study of grammar, vocabulary, and idioms with emphasis on conversational skills. Includes continued discussion of the culture of the language being taught. Languages taught may include but are not limited to Ojibwa and Japanese. Credits: 3.0; 3-semesters Offered: Spring Restrictions: May not be enrolled in one of the following Classes(s): Senior Prerequisites: HU 1241

HU 2110 Creative Writing Writing practice in one or more of the major creative genres, including poetry, short fiction, and literary nonfiction. Combines creative theory with process-oriented writing exercises. Stresses a workshop approach and requires a portfolio of creative work at term’s end. Credits: 3.0; 3-semesters Offered: Spring

Introduction to Rhetoric Examines the classical origins, cultural contexts, and contemporary relevance of rhetorical traditions. Credits: 3.0; 3-semesters Offered: Fall

Level II-A French Language and Culture Review of basic grammar, introduction to advanced idiom, translation of material from French to English, and writing of compositions in French. Credits: 3.0; 3-semesters Offered: Fall Prerequisites: HU 1213 or HU 1215 or HU 1212

Level II-B French Language and Literature Reading of French texts, and writing of compositions in French. Includes the use of oral French in the classroom. Credits: 3.0; 3-semesters Offered: Spring Prerequisites: HU 1212 or HU 1213 or HU 1215

Level II-A German Language and Culture Review of basic German grammar. Includes study of vocabulary, idioms, and word formation to improve conversational and reading abilities, and discussion of various aspects of contemporary German culture. Credits: 3.0; 3-semesters Offered: Fall; Spring Restrictions: May not be enrolled in one of the following Classes(s): Junior Senior

Level II-B German Language and Literature Reading of German texts, and writing of compositions in German. Includes the use of oral German in the classroom. Credits: 3.0; 3-semesters Offered: Spring Prerequisites: HU 1222 or HU 1223 or HU 1225

Level II German Composition and Conversation Extensive work on the creative use of written and oral French, and short themes in French. Conducted as much as possible in French. Credits: 3.0; 3-semesters Offered: Spring Prerequisites: HU 1212 or HU 1213 or HU 1215

Level II-A Spanish Language and Culture Intensive review of Spanish grammar and further vocabulary development. Credits: 3.0; 3-semesters Offered: Fall; Spring Prerequisites: HU 1222 or HU 1223 or HU 1225

Level II-B Spanish Language and Literature Composition and conversation based on the reading of Spanish texts, including literature and newspapers. Conducted as much as possible in Spanish. Credits: 3.0; 3-semesters Offered: Spring Prerequisites: HU 1222 or HU 1223 or HU 1225

Level II Spanish Composition and Conversation Extensive work on the creative use of written and oral Spanish, and short themes in Spanish. Conducted as much as possible in Spanish. Credits: 3.0; 3-semesters Offered: Spring Prerequisites: HU 1222 or HU 1223 or HU 1225

Introduction to Film An introduction to the concepts, terminology, history, and criticism of film. Emphasizes a critical examination of film within its social, cultural, and historical contexts. Assignments may include essays, short writings, or exams in which students demonstrate their knowledge of concepts and issues introduced through readings, screenings, and discussions. Credits: 3.0; 3-semesters Offered: Fall Spring

The American Experience in Literature I A survey of writings and the oral tradition from the earliest explorers, Native Americans, and African-Americans to about 1850. Readings in such genres as histories, diaries, sermons, poetry, and short stories. Credits: 3.0; 3-semesters Offered: Fall; offered alternate years beginning with the 2000–01 academic year

The American Experience in Literature II A historical survey of American literature from about 1850 to the present, focusing on such themes as nature, the individual, democracy, race, optimism, and science. Credits: 3.0; 3-semesters Offered: Fall; offered alternate years beginning with the 2001–02 academic year

Science, Technology, and Humanities I A survey using literary texts, narrative history, documentary evidence, film, music, and cross-cultural references to contextualize the emergence of scientific, technological, and humanistic developments in the nineteenth and twentieth centuries. Credits: 3.0; 3-semesters Offered: Fall; offered alternate years beginning with the 2000–01 academic year

Science, Technology, and Humanities II A survey using literary texts, narrative history, documentary evidence, film, music, and cross-cultural references to contextualize the emergence of scientific, technological, and humanistic developments in the nineteenth and twentieth centuries. Credits: 3.0; 3-semesters Offered: Fall; offered alternate years beginning with the 2001–02 academic year

Anglo-American Literary Studies An introduction to a variety of twentieth-century Anglo-American critical approaches, such as New Critical, archetypal, cultural, feminist, gay/lesbian, and reader-response, and to critical readings of literary texts from different perspectives. Credits: 3.0; 3-semesters Offered: Spring; offered alternate years beginning with the 2000–01 academic year

Cultural Diversity in American Literature Study of short stories, plays, novels,
literary nonfiction by authors of the Americas (e.g., Latin America, South America, Mexico, the United States, Canada, and the Caribbean). Emphasizes works by authors of historically under-represented groups (e.g., Latino, Native American, Latin American, Canadian, African-American, and Caribbean). Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Spring

HU 2358 British Experience in Literature I A survey of major works of British literature from Beowulf to the Restoration with special focus on the stages of the developing English language as represented in the works of Chaucer; the Gawain poet, Margery Kempe, Shakespeare, Spenser, Marlowe, Donne, J. Jonson, Milton, Aphra Behn, Dryden, and Pope. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Fall; offered alternate years beginning with the 2000–01 academic year

HU 2359 British Experience in Literature II A survey of major works of British literature from the nineteenth and twentieth centuries, including such authors as Wordsworth, Byron, Mary Shelley, Coleridge, Keats, Elizabeth Barrett Browning, Tennyson, Hardy, Dickens, Yeats, D.H. Lawrence, Virginia Woolf, T.S. Eliot, Katherine Mansfield, W.H. Auden, and Doris Lessing. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Fall; offered alternate years beginning with the 2001–02 academic year

HU 2547 World Drama Study of the forms of dramatic literature from around the world as they appear within the context of theatre, with particular attention to thematic and dramatic development. Emphasis is on the performance as well as the literary aspects of the plays covered to assure some understanding of the theatrical experience. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Spring; offered alternate years beginning with the 2001–02 academic year

HU 2548 Adolescent Literature Reading, responding to, and reflecting on a range of literary fiction and literary nonfiction appropriate for adolescents. Works will include authors from different cultures, races, historical periods, and genders. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Fall

HU 2600 Introduction to Scientific and Technical Communication An introduction to the history, theory, and practice of scientific and technical communication. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Fall Restrictions: Must be enrolled in one of the following Major(s): Scientific Tech Comm (BA) Scientific Tech Comm (BS)

HU 2631 Fundamentals of Photography Provides students with an understanding and appreciation of contemporary imaging technologies and their applications. Reviews the history of photographic imaging and a survey of professional imaging applications. Students will understand camera optics and controls and learn to recognize, capture, process, and produce quality images using chemical and/or digital imaging devices. Credits: 3.0 Lec-Rec-Lab: (2-2-3) Semesters Offered: Fall

HU 2644 Computer Applications in Communication Introduction to computer systems, programs, and applications that support communication projects. Students work through a series of core modules that acquaint them with network operations, network information systems, capture technologies, word-processing, graphic and drawing packages, and document-design programs. They will also analyze and evaluate hardware and software systems. Credits: 3.0 Lec-Rec-Lab: (2-0-3) Semesters Offered: Fall Spring

HU 2645 Graphic and Information Design A computer-intensive introduction to the principles for creating clear, effective graphic communication. Students critique the work of other designers in terms of the work’s audience and intended effect, and they construct and critique their own design projects as well. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Fall Prerequisites: HU 2644 or permission of instructor

HU 2650 Introduction to Web-Site Design Provides experience in planning and constructing web pages. Discusses historical, ethical, and social implications of the Internet and digital culture. Students will develop a balance of technical and aesthetic knowledge and an understanding of some of the problems and limitations of the Internet and the World Wide Web. Credits: 3.0 Lec-Rec-Lab: (2-2-3) Semesters Offered: Spring

HU 2700 Introduction to Philosophy A study of thought representing various traditions such as classical and contemporary philosophy, Eastern and Western religions, and issues in recent science. Some basic concepts of logic are also examined. Emphasizes moral philosophy, including ethical relativism, utilitarianism, and Kantian ethics. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Fall Spring

HU 2701 Logic and Critical Thinking Introduction to everyday reasoning and formal logic. Important goal is to develop skills of argument identification, analysis, and evaluation. Students learn how to symbolize ordinary language statements and arguments and to determine their validity or invalidity using proof and truth-table methods. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Spring; offered alternate years beginning with the 2000–01 academic year

HU 2820 Communication and Culture Introduction to the ways that communication creates and maintains culture. Considers a variety of perspectives on the significance of communication. Explores the importance of communication for understanding culture. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Fall

HU 2830 Introduction to Speech Communication Introduction to the diversity of theories and methodologies in speech communication studies. Explores patterns and dynamics of communication across situational contexts and critically examines common assumptions and contemporary issues in communication. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Fall

HU 2910 Language and Mind Introduction to the linguistic study of structural and cognitive aspects of language. Topics may include examination of sounds, words, sentences, and discourse; oral, written, and electronic variation; the comparison of human ability with animals and computers; first and second language acquisition; brain architecture; the classification and distribution of world languages. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Fall

HU 2920 Language and Society The study of how societies regard, use, and organize themselves with respect to language. Topics may include dialect variation based on geography, class, ethnicity, gender, etc.; language distribution and multilingualism around the world; the history and future position of English; language standards and attitudes towards minority language variants or bilingualism. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Spring

HU 3120 Technical and Scientific Communication A study of written and oral communication in technical and scientific environments; emphasizes audience, writing processes, genres of scientific and technical discourse, visual communication, collaboration, professional responsibility, clear and correct expression. Students write and revise several documents and give oral report(s). Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Fall Spring Restrictions: Must be enrolled in one of the following Class(es): Jr or Senior Prerequisites: UN 1002 or UN 1003 or UN 2002

HU 3130 Rhetorical Theory and Criticism A study of contemporary theories of rhetoric and their application to understanding and criticizing various forms of persuasive discourse. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Spring Prerequisites: UN 1002 or UN 1003

HU 3150 Reading and Writing A study of how and why different groups of people use reading and writing differently in varying situations and in varying textual media. Topics may include the various ways texts function and reading is used; the authority of written texts; access to reading and writing and a critical perspective on texts. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Fall Spring Restrictions: Must be enrolled in one of the following Class(es): Jr or Senior Prerequisites: UN 1002 or UN 1003 and UN 2001 or permission of instructor

HU 3151 The Rhetoric of Everyday Texts The examination and production of everyday texts such as image-texts, e-mail, web pages, signs, museum exhibits, architecture, and fashion in terms of their theoretical, historical, cultural, and technological contexts. Students should expect to produce “everyday texts” of their own as well as write about texts examined in the course. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Fall Spring Prerequisites: UN 1002 or UN 1003

HU 3211 Topics in French Literature A survey of French literature or various aspects of modern French civilization and culture, emphasizing historical and cultural backgrounds. Conducted primarily in French. Credits: 3.0; repeatable to a max of 6 Lec-Rec-Lab: (0-3-0) Semesters Offered: Fall; offered alternate years beginning with the 2000–01 academic year Prerequisites: HU 2212 or (HU 2211 and HU 2215) and (UN 1002 or UN 1003)

HU 3212 French for Special Purposes Selected topics as posed by business, technical, scientific and/or literary discourses in the context of French language and Francophone culture. Credits: variable to 3.0; repeatable to a max of 6 Lec-Rec-Lab: (0-3-0) Semesters Offered: Spring Prerequisites: UN 1002 or UN 1003

HU 3213 Topics in German Literature A selected topic of German literature and culture considered in depth. Topics for discussion in German may include postwar German literature, the contemporary German short story, Germany since WW II, or may include emphasis on a major contemporary writer. Conducted in German. Credits: 3.0; repeatable to a max of 6 Lec-Rec-Lab: (0-3-0) Semesters Offered: Fall; offered alternate years beginning with the 2001–02 academic year Prerequisites: HU 2222 or (HU 2221 and HU 2225) and (UN 1002 or UN 1003)

HU 3221 German for Special Purposes Introduction to issues of science and technology in German-speaking societies. As far as language acquisition is concerned, special attention is given to scientific and technical German. Credits: variable to 3.0; repeatable to a max of 6 Lec-Rec-Lab: (0-3-0) Semesters Offered: On Demand Prerequisites: HU 2212 or (HU 2215 and HU 2211) and (UN 1002 or UN 1003)

HU 3222 Topics in Spanish Literature A brief survey of the literature, culture, and civilization of a particular region or regions of the Spanish-speaking world. May incorporate study of literary genres and historical periods as related to Spain and/or Latin American cultures. Credits: 3.0; repeatable to a max of 6 Lec-Rec-Lab: (0-3-0) Semesters Offered: Fall; offered alternate years beginning with the 2000–01 academic year Prerequisites: HU 2232 or (HU 2231 and HU 2235) and (UN 1002 or UN 1003)

HU 3223 Spanish for Special Purposes Selected topics as posed by business, technical, scientific and/or literary discourses in the context of Hispanic language and culture. Credits: variable to 3.0; repeatable to a max of 6 Lec-Rec-Lab: (0-3-0) Semesters Offered: On Demand Prerequisites: HU 2232 or (HU 2231 and HU 2235) and (UN 1002 or UN 1003) or permission of instructor

HU 3231 Modern Masters Study of such topics as world literature in translation, the modern novel and drama, the symbolist poets, and naturalism in modern world literature. Credits: 3.0; repeatable to a max of 6 Lec-Rec-Lab: (0-3-0) Semesters Offered: Fall Spring Restrictions: May not be enrolled in one of the following Class(es): Freshman Prerequisites: UN 1002 or UN 1003

HU 3232 Literature in Translation Study of noncanonical literature in English translation of
Western and non-Western authors. Credits: 3.0; repeatable to a max of 6 Lec-Rec-Lab: (0-3-0) Semesters Offered: Spring Restrictions: May not be enrolled in one of the following Class(es): Freshman Prerequisites: UN 1002 or UN 1003

HU 3523 Essays of World Cultures Comparative approach to selected essays in English translation of Western and non-Western authors. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Fall Restrictions: May not be enrolled in one of the following Class(es): Freshman Prerequisites: UN 1002 or UN 1003

HU 3526 Intercultural Communication Comparative study of interpersonal communication across cultures by both foreign and American students, with emphasis on cultural patterns, attitudes, values, and nonverbal behaviors. Instructor selects cultures for study from Third World, Western, or non-Western regions. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Spring Restrictions: May not be enrolled in one of the following Class(es): Freshman Prerequisites: UN 1002 or UN 1003

HU 3526A Topics in Francophone Cultures An introduction to Francophone cultures (in English) in a comparative perspective. Includes a survey of French history and its influence on modern-day French and Francophone societies through movies, media, and recent technologies, and a critical examination of cross-cultural differences between French and American cultures. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Spring Restrictions: May not be enrolled in one of the following Class(es): Freshman Prerequisites: UN 1002 or UN 1003

HU 3526B Topics in German-Speaking Cultures An introduction to German-speaking culture (in English) in a comparative perspective. Includes a survey of Central-European history and its influence on modern-day German-speaking societies through movies, media, and recent technologies, and a critical examination of cross-cultural differences between German and North-American cultures. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Spring Restrictions: May not be enrolled in one of the following Class(es): Freshman Prerequisites: UN 1002 or UN 1003

HU 3526C Topics in Spanish-Speaking Cultures An introduction to Spanish-speaking cultures (in English) in a comparative perspective. Includes a survey of European and Latin-American history and its influence on modern-day Spanish-speaking societies through movies, media, and recent technologies, and a critical examination of cross-cultural differences between exclusively Spanish-speaking cultures and North-American society. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Spring Restrictions: Permission of instructor required; must be enrolled in one of the following Class(es): Junior Prerequisites: UN 1002 or UN 1003

HU 3324 Visual Media Analysis Introduction to selected topics in contemporary visual media. Topics may include genre studies, national cinema, independent film and video, auteur approaches, and other contemporary issues. Students will examine critically the theoretical, industrial, cultural, and aesthetic challenges posed by particular films and the contexts from which they emerge. Credits: 3.0 Lec-Rec-Lab: (0-2-3) Semesters Offered: Spring Restrictions: Permission of instructor required; must be enrolled in one of the following Class(es): Junior Prerequisites: UN 1002 or UN 1003

HU 3501 Medieval Literature Study of such topics as King Arthur, mystery plays, the epic, and Dante's Divine Comedy as part of the literature of the Middle Ages. Selected topics are offered every other year by individual instructors. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Fall; offered alternate years beginning with the 2000–01 academic year Prerequisites: UN 1002 or UN 1003

HU 3502 World Mythologies Survey of the major mythological systems of the world with particular attention to those areas of commonality between the various civilizations. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Spring; offered alternate years beginning with the 2001–02 academic year Prerequisites: UN 1002 or UN 1003

HU 3504 Novels from World Literature Comparative approach to selected novels of Western and non-Western authors, excluding English and North American, and including works by non-European writers. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Fall; offered alternate years beginning with the 2000–01 academic year Prerequisites: UN 1002 or UN 1003

HU 3510 The American Novel Examination of the novel in America with special attention to the historical, sociological, and personal contexts within which the author is writing. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Fall Prerequisites: UN 1002 or UN 1003

HU 3512 Shakespeare I Study of selected plays by Shakespeare including comedies, histories, and tragedies. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Fall Prerequisites: UN 1002 or UN 1003

HU 3513 Shakespeare II In-depth study of a limited number of Shakespearean plays with special attention to dramatic structure, character development, theme presentation, and theatre history. Includes extensive study of Renaissance influences and examination of current critical theories. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Spring Prerequisites: UN 1002 or UN 1003

HU 3540 Major British Authors Reading in depth from the works of one or more of the major British writers, excluding Shakespeare. Credits: 3.0; repeatable to a max of 6Lec-Rec-Lab: (0-3-0) Semesters Offered: Fall Prerequisites: UN 1002 or UN 1003

HU 3541 Major American Authors Reading in depth of the works of one or more major American writers. Credits: 3.0; repeatable to a max of 6Lec-Rec-Lab: (0-3-0) Semesters Offered: Spring Prerequisites: UN 1002 or UN 1003

HU 3551 Renaissance English Literature Study of important figures and genres in English literature from the late-seventeenth century through the eighteenth century. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Spring; offered alternate years beginning with the 2000–01 academic year Prerequisites: UN 1002 or UN 1003

HU 3552 Restoration and 18th Century English Literature Study of important figures and genres in English literature from the late-seventeenth century through the eighteenth century. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Spring Prerequisites: UN 1002 or UN 1003

HU 3554 Nineteenth-Century British Literature Readings of selected figures and works from the romantic and Victorian periods. Genres include poetry, prose, and novels. Major topics include nature, transcendentalism, imagination, the growth of science and its impact on religious faith, and the fate of humanistic culture in a technological age. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Fall Prerequisites: UN 1002 or UN 1003

HU 3555 Twentieth-Century British Literature Study of British, British colonial, and independence literature of the twentieth century. Will explore relationships between literature and other areas such as the arts, architecture, history, and philosophy in discussions of such movements as modernism and postmodernism. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Spring; offered alternate years beginning with the 2001–02 academic year Prerequisites: UN 1002 or UN 1003

HU 3605 Grammar and Usage in Society Description and analysis of current standards of grammar and usage in the U.S. Students acquire an understanding of the structures of American English as well as an understanding of the social forces underlying standardization and the processes of language change. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Fall; offered alternate years beginning with the 2001–02 academic year Prerequisites: UN 1002 or UN 1003

HU 3606 Editing Examination of the responsibilities of an editor and grounding in basic editorial skills. Topics include situations of editing, levels of editing, readability, correctness, style, relations with authors, and social and political implications of editing. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Spring Restrictions: Must be enrolled in one of the following Class(es): Junior Prerequisites: UN 3605 or permission of instructor

HU 3621 Introduction to Journalism Introduction to the history and practice of journalism. Includes critical analysis of journalistic coverage, journalistic style and editing, and ethical issues in journalism. Credits: 3.0 Lec-Rec-Lab: (0-2-3) Semesters Offered: Fall Prerequisites: UN 2001 and UN 1002 or UN 1003

HU 3629 Practical Writing Fundamentals of practical writing expected of professionals. Types of practical writing considered may include newsletters, brochures, ghost speech writing, procedure writing, e-mail notices, manuals, etc. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Spring Prerequisites: UN 2644 or permission of instructor

HU 3630 Publications and Information Management Principles of information selection, editing, layout, and graphics essential to the scheduling, budgeting, and production of various print and digital publications. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Spring Prerequisites: HU 2644 or permission of instructor

HU 3635 Television Production I Basic theories and practices of television production, including writing scripts, directing, and operating studio equipment. Considers evaluations of video productions, societal effects of television, and legal and ethical issues from a production perspective. Student projects emphasize creative and persuasive productions. Credits: 3.0 Lec-Rec-Lab: (0-1-4) Semesters Offered: Fall Prerequisites: UN 1002 or UN 1003

HU 3636 Television Production II Advanced theories and practices of television production, including preproduction planning, writing scripts, computer graphics, and operation of portable equipment. Considers evaluation of film and video productions, societal effects of television, and aesthetics of film and television. Emphasizes on-location shooting and postproduction editing. Student projects emphasize creative productions. Credits: 3.0 Lec-Rec-Lab: (0-1-4) Semesters Offered: Spring; offered alternate years beginning with the 2001–02 academic year Prerequisites: HU 3634 or permission of instructor

HU 3642 Introduction to Multimedia Development A hands-on and theoretical introduction to multimedia development. Students construct a prototype multimedia project. They plan a project; construct a project team; design an effective interface integrating color, sound, and graphics; and test. Students analyze multimedia projects and writings about multimedia. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Fall Prerequisites: HU 2644 and UN 1002 or UN 1003

HU 3700 Philosophy of Science Examination of problems involved in scientific methodology such as theory structure, concept formation, scientific explanation, hypothetico-deductive model, role of experimentation, function of paradigms and analogies, distinction between science and pseudoscience, extent to which science is value-free or value-laden, social responsibility of scientists, and aims of science. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Fall Prerequisites: HU 2700 and UN 2002

HU 3701 Philosophy of Technology A study of philosophical aspects of technology Topics
may include technology and progress; technology and ideology; technology and nature; technological determinism; ethics and technology; technology as a worldview; gender, race, class, and technology; and the relationship between technology and dystopias, utopias, and the “good life.” Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Spring Prerequisites: HU 2700 and UN 2002 or permission of instructor

HU 3711 Biomedical Ethics A study of several important ethical and philosophical issues that arise in medical practice and in biomedical science. Issues may include euthanasia, abortion, the physician-patient relationship, experimentation involving human subjects, and the allocation of scarce biomedical resources. General ethical theories and concepts are used to shed light on those issues. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Spring; offered alternate years beginning with the 2000–01 academic year Prerequisites: HU 2700 and (UN 1002 or UN 1003)

HU 3820 Interpersonal Communication Introduces theories of interpersonal communication. Considers communication issues in various relational contexts such as acquaintance relationships, friendships, kinships, and workplace relations. Encourages critical awareness of the common assumptions about interpersonal interactions. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Spring; offered alternate years beginning with the 2001–02 academic year Prerequisites: UN 1002 or UN 1003

HU 3840 Organizational Communication An approach to understanding organizations in their socio-historical contexts from a variety of theoretical perspectives in communication. Explores meanings, roles, relations, interactions, and structures from a communication perspective. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Spring Prerequisites: UN 1002 or UN 1003

HU 3850 Cultural Studies Examines history, theory, and methods of cultural studies. Explores cultural studies’ understanding of the significance and meaning of cultural practices in a variety of contexts. Considers diverse practices such as advertising, art, music, and education. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Spring; offered alternate years beginning with the 2001–02 academic year Prerequisites: UN 1002 or UN 1003

HU 3860 Popular Culture Explores specific examples of popular culture that reveal how popular values, feelings, and beliefs are created and maintained. Considers the historical, social, political, and economic contexts of popular culture from a communication perspective. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Spring Prerequisites: UN 1002 or UN 1003

HU 3910 Language in the World The consideration of linguistic issues in the distribution and use of language in the world. Topics may include how power is created, enacted, and maintained through language; gender variation in language; critical discourse analysis; nationalism and ethnic identity via language; endangered languages; world Englishes. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Spring; offered alternate years beginning with the 2000–01 academic year Prerequisites: UN 1002 or UN 1003

HU 3920 Language and Technology The consideration of the linguistic issues behind different modalities of technologically mediated communication, especially how different technologies affect the form and content of language as compared to both oral conversation and written texts. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Spring; offered alternate years beginning with the 2001–02 academic year Prerequisites: UN 2002

HU 3930 Language and Education The consideration of language variation across the domains of academia. Topics may include the forms of language used in classrooms, different genres of academic discourse, the transition to academic literacy from oral competence, etc. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Spring; offered alternate years beginning with the 2002–03 academic year Prerequisites: UN 1002 or UN 1003

HU 4050 Special Topics Tutorial, seminar, workshop, or class study of special interest and importance in the humanities. Students should register by section number for the appropriate instructor and topic. Credits: variable to 6.0 May be repeated Lec-Rec-Lab: (0-0-0) Semesters Offered: On Demand Restrictions: Permission of instructor required

HU 4060 Humanities Workshop Special workshop projects in the humanities such as tutorials, editing. Shakespeare Faire drama workshop, writer’s workshop, or study-abroad tours. Approved credit varies by degree program. Credits: variable to 6.0; may be repeated Lec-Rec-Lab: (0-0-0) Semesters Offered: On Demand Restrictions: Permission of instructor required

HU 4071 Liberal Arts Capstone Project A one-semester research project which demonstrates the skills in and knowledge of one or more disciplines covered by the major. Work is carried out under the supervision of a faculty advisor and results in a project that includes a writing component of substantial length. Credits: 3.0 Lec-Rec-Lab: (0-1-0) Semesters Offered: Fall Spring Restrictions: Must be enrolled in one of the following Major(s): Liberal Arts; must be enrolled in one of the following Classies: Senior Writing Center Practicum Reflective practicum in which theories of learning, literacy, and cultural differences are applied in the writing center setting under the supervision of a writing center professional. Credits: 1.0 May be repeated Lec-Rec-Lab: (0-1-0) Semesters Offered: Fall Spring Restrictions: Permission of instructor required Prerequisites: UN 1001 and (UN 1002 or UN 1003) and UN 2001(C)

HU 4110 Advanced Creative Writing Intensive practice in one of the major creative genres, including poetry, short fiction, and literary nonfiction. The class combines workshops with occasional verbal conferences (such as the goal of producing several pieces of creative work polished to publication standards. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Spring; offered alternate years beginning with the 2001–02 academic year Prerequisites: HU 2110 and UN 2001(C) or permission of instructor

HU 4130 Special Topics in Rhetoric or Composition An in-depth examination of selected problems, issues, periods, theorists, or concepts in rhetoric (such as rhetoric and the environment, feminist rhetoric, the rhetoric of science, classical rhetoric, the Sophists, argumentation theory) or composition studies (such as literacy practices in social contexts, voice, computer processes, world Englishes, computers and writing). Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Spring; offered alternate years beginning with the 2000–01 academic year

HU 4140 Methods of Teaching English Application of learning theories and national and state professional standards to the teaching of English. Emphasizes methods, materials, and media used to teach adolescents. Credits: 4.0 Lec-Rec-Lab: (0-3-3) Semesters Offered: Fall Restrictions: Permission of department required Prerequisites: ED 3110 and ED 3120 and ED 3310 and ED 3410

HU 4150 Literacy in the Content Areas Introduction to literacy practices and methods for improving content understanding that focus on language. Designed for preservice secondary teachers. Emphasizes strategies for comprehending and interpreting texts and a close examination of cultural and learning differences. Field experience involves tutoring in secondary schools. Credits: 4.0 Lec-Rec-Lab: (0-3-1) Semesters Offered: Fall Spring Prerequisites: ED 3110(C) or permission of instructor

HU 4211 Modern Language Seminar I-French Language and power. Critical study of the representation of politics, economics, and social institutions in literature, film, and authentic documents from French, German, and Hispanic language communities. Students read texts in French and in English translation. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Spring Prerequisites: HU 3211 or HU 3212 and UN 2002

HU 4212 Modern Lang Seminar II-French Individual and Society Critical study of the relationship between the individual and social institutions in literature, film, and authentic documents from French, German, and Hispanic language communities. Students read texts French and in English translation. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Spring; offered alternate years beginning with the 2001–02 academic year Prerequisites: HU 3211 or HU 3212 and (UN 1002 or UN 1003)

HU 4213 Modern Lang Seminar III-French Technology in Literature and Film Critical study of the relationship between modern technology and literature, film, and authentic documents from French, German, and Hispanic language communities. Students read texts in French and in English translation. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Spring Prerequisites: HU 3211 or HU 3212 and UN 2002 or permission of instructor

HU 4221 Modern Language Seminar I-German Language and Power Critical study of the representation of politics, economics, and social institutions in literature, film, and authentic documents from French, German, and Hispanic language communities. Students read texts in German and in English translation. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Spring; offered alternate years beginning with the 2001–02 academic year Prerequisites: HU 3221 or HU 3222 and (UN 1002 or UN 1003)

HU 4222 Modern Language Seminar II-German Individual and Society Critical study of the relationship between the individual and social institutions in literature, film, and authentic documents from German, French, and Hispanic language communities. Students read texts in German and in English translation. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Spring Prerequisites: HU 3221 or HU 3222 and UN 2002 or permission of instructor

HU 4223 Modern Lang Seminar III-German Technology in Literature and Film Critical study of the relationship between modern technology and literature, film, and authentic documents from German, French, and Hispanic language communities. Students read texts in Spanish and in English translation. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Spring; offered alternate years beginning with the 2001–02 academic year Prerequisites: HU 3221 or HU 3222 and (UN 1002 or UN 1003) or permission of instructor

HU 4231 Modern Language Seminar I-Spanish Language and Power Critical study of the representation of politics, economics, and social institutions in literature, film, and authentic documents from German, French, and Hispanic language communities. Students read texts in Spanish and in English translation. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Spring; offered alternate years beginning with the 2001–02 academic year Prerequisites: HU 3231 or HU 3232 and (UN 1002 or UN 1003)

HU 4232 Modern Language Seminar II-Spanish Individual and Society Critical study of the relationship between the individual and social institutions in literature, film, and authentic documents from French, German, and Hispanic language communities. Students read texts in Spanish and in English translation. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Spring; offered alternate years beginning with the 2001–02 academic year Prerequisites: HU 3231 or HU 3232 and (UN 1002 or UN 1003) or permission of instructor

HU 4233 Modern Lang Seminar III-Spanish Technology in Literature and Film Critical
study of the relationship between modern technology and literature, film, and authentic documents from French, German, and Hispanic language communities. Students read texts in Spanish and in English translation. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Spring; offered alternate years beginning with the 2000–01 academic year Restrictions: Must be enrolled in one of the following Major(s): Junior or Senior Prerequisites: In 1002 or 1003 or permission of instructor

HU 4542 Topics in American Literature Selected problems posed by literary genres, themes, movements, and individual authors. In American literature. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Spring; offered alternate years beginning with the 2001–02 academic year Restrictions: Must be enrolled in one of the following Class(es): Junior or Senior Prerequisites: In 1002 or 1003 or permission of instructor

HU 4545 Topics in World Literature Study of literary genres, themes, and movements, with emphasis on comparing and contrasting ideas, perspectives, and cultural aspects presented or reflected in world literature. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Fall; offered alternate years beginning with the 2000–01 academic year Restrictions: Must be enrolled in one of the following Class(es): Junior or Senior Prerequisites: In 1002 or 1003 or permission of instructor

HU 4625 Risk Communication Examines models for communicating risks associated with environmental, safety, and health hazards. Considers the diverse roles assumed by the public under each of these models and means of ensuring that risks are communicated fairly, honestly, and accurately. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Spring; Restrictions: Must be enrolled in one of the following Class(es): Junior or Senior Prerequisites: In 2002 or permission of instructor

HU 4628 Reading and Usability in Technical Communication The role of readability and usability in technical communication. Topics include social, cultural, and cognitive theories of reading processes, navigation, print and online document design. Applies readability and usability testing techniques to typical print materials as well as online documents, digital libraries or databases, multimedia, or software interfaces. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Spring; offered alternate years beginning with the 2000–01 academic year Restrictions: Prerequisites: HU 3120 or permission of instructor

HU 4634 Advanced Practicum in Technical Communication Examines current research and theory in technical communication. In applying this research and theory, students work with a client and/or the course instructor to manage technical communication projects. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Spring; Fall; Restrictions: Must be enrolled in one of the following Major(s): Scientific Tech Comm (BA) Scientific Tech Comm (BS) Prerequisites: HU 3120 and HU 2644 or permission of instructor

HU 4642 Special Topics in Advanced Media Development Critical and practical topics in the quickly changing media of our time. Topics may include digital photography, advanced multimedia development, advanced graphic design, color theory, or three-dimensional modeling and rendering. Credits: 3.0 Lec-Rec-Lab: (0-2-3) Semesters Offered: Spring; Restrictions: Permission of instructor required Prerequisites: In 1002 or In 1003

HU 4690 Topics in Communication In-depth examination of selected issues or problems in the study of communication. Topics may include cultural differences in behavior, values, roles, culture shock, stereotypes, false assumptions, nonverbal communication, ethnocentrism and stress release. Credits: 3.0 Lec-Rec-Lab: (0-2-0) Semesters Offered: Fall Spring Restrictions: Permission of department required

International Studies (IS)

IS 3380 Preorientation Orientation Prepares student for study or internships abroad. In addition to providing technical information on permits, health issues, current events, the course also deals with topics such as cultural differences in behavior, values, roles, culture shock, stereotypes, false assumptions, nonverbal communication, ethnocentrism and stress release. Credits: 2.0 Lec-Rec-Lab: (0-2-0) Semesters Offered: Fall Spring Restrictions: Permission of department required

Library Sciences (LB)

LB 0211 Information Sources for Business, Humanities and Social Sciences Develops a working knowledge of information sources and concepts essential to both research and professional practice in business, the humanities, and the social sciences. Includes print and electronic materials. After gaining experience using general sources, students focus on resources and methods specific to their discipline. Credits: 1.0 Lec-Rec-Lab: (0-1-0) Semesters Offered: Fall; Restrictions: May not be enrolled in one of the following Class(es): Freshman

LB 0212 Information Sources for Science and Engineering An introduction to science and engineering information sources and concepts. Examines both paper and electronic materials. Sources selected will include those specific to each student’s field of study. Credits: 1.0 Lec-Rec-Lab: (0-1-0) Semesters Offered: Spring; Restrictions: May not be enrolled in one of the following Class(es): Freshman

Mathematical Sciences (MA)

MA 0010 Development of Mathematics Skills Individualized instruction in mathematics problem solving and general study skills from professional math coaches. Helps students with demanding college-level mathematics courses. Credits do not count toward graduation. Credits: 1.0; repeatable to a max of 5; graded Pass/Fail only Lec-Rec-Lab: (0-0-2) Semesters Offered: Fall Spring

MA 0020 Team Approach to Learning Mathematics Collaborative approach to the study of mathematics. Students meet 3 hours per week with 4 to 6 team members who are concurrently taking the same math course under the direction of a professional math coach to learn the team approach to problem solving. Helps students with demanding college-level mathematics courses and gives experience in team problem solving. Students must be enrolled in one of the following: MA1032, 1033, 1150, 1151, 1161, 2150, 2160, 3150, 3160, 3520, or 3530. Credits do not count toward graduation. Credits: 1.0; repeatable to a max of 5; graded Pass/Fail only Lec-Rec-Lab: (0-3-0) Semesters Offered: Fall Spring Restrictions: Permission of instructor required

MA 1032 Data, Functions, Graphs Plus Review of algebra and trigonometry covering roots, radicals, factoring, polynomial and rational expressions, equations and inequalities, functions and graphs, trigonometric graphs, identities and equations and inverse trigonometric functions. MA1032 is similar to MA1033, but goes at a slower pace and incorporates cooperative learning study skills. Credits: 4.0 Lec-Rec-Lab: (0-4-0) Semesters Offered: Fall Summer

MA 1033 Data, Functions, Graphs Review of algebra and trigonometry covering roots, radicals, factoring, polynomial and rational expressions, equations and inequalities, functions and graphs, trigonometric graphs, identities and equations and inverse trigonometric functions. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Fall Spring

MA 1040D Math for Design I (Distance Program) Basic mathematical background for mechanical and electrical engineers and designers. Topics include use of calculators, basic algebra, solving systems of linear equations, vectors in 2- and 3-dimensions, interpolation and estimating areas. Emphasizes practical application, rather than theoretical methods. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Fall Spring

MA 1041D Math for Design II (Distance Program) Continuation of MA1040D. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Spring Prerequisites: MA 1040D

MA 1090 Functions, Change, and Chance Survey of mathematical ideas and reasoning for computer science majors. Topics may include difference equations and recursion, proof by induction, random number generators and elementary number theory, game trees and strategy, probability, and simulation. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Fall Spring Restrictions: Must be enrolled in one of the following Major(s): Computer Science

MA 1135 Calculus for Life Sciences Topics include analytic geometry, limits, continuity of regulatory dimensions of global communication. Topics include nation, nationalism, culture and communication, comparative studies of international media systems, communication and development, international relations and media, the rise of global culture, cultural autonomy and globalization. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Spring Prerequisites: In 1002 or 1003

MA 4830 Philosophy of Communication Focuses on questions such as what is communication? and how is communication possible? Introduces students to the philosophical examination of various assumptions and the role those assumptions play in the practice of communication. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Fall; offered alternate years beginning with the 2000–01 academic year Prerequisites: In 1002 or In 1003

MA 4840 International Communication Examines cultural, social, political, economic, and
functions, transcendental functions, derivatives, integrals, and applications of the derivative in fields of economics, biological sciences, and social sciences. Extensive use of graphing calculator. (See mathematical sciences department for recommended calculator.) Credit applicable only to those curricula specifying this course. Credits: 4.0 Lec-Rec-Lab: (0-4-0) Semesters Offered: Fall Spring Prerequisites: MA 1032 or MA 1033

MA 1150 Calculus I An introduction to single-variable calculus. Topics include functions, limits, continuity, differentiation and its uses, and integration. Credits: 4.0 Lec-Rec-Lab: (0-4-0) Semesters Offered: Fall Spring Summer Prerequisites: MA 1032 or MA 1033

MA 1151 Calculus I Plus An introduction to single-variable calculus. Topics include functions, limits, continuity, differentiation and its uses, and integration. MA1151 is similar to MA1150, but goes at a slower pace and incorporates cooperative learning study skills. Credits: 5.0 Lec-Rec-Lab: (0-5-0) Semesters Offered: Fall Summer

MA 1160 Calculus with Technology I An introduction to single-variable calculus, which includes a computer laboratory. Topics include trigonometric, exponential, and logarithmic functions, differentiation and its uses, and basic integration. Integrates symbolic tools, graphical concepts, data, and numerical calculations. Credits: 4.0 Lec-Rec-Lab: (0-4-0) Semesters Offered: Fall Spring Summer Prerequisites: MA 1032 or MA 1033

MA 1161 Calculus Plus w/ Technology I An introduction to single-variable calculus, which includes a computer laboratory. Topics include trigonometric, exponential, logarithmic functions, differentiation and its uses, and basic integration. Integrates symbolic tools, data and numerics, and graphical concepts and is similar to MA 1160, going at a slower pace and incorporating cooperative learning study skills. Credits: 5.0 Lec-Rec-Lab: (0-5-0) Semesters Offered: Fall

MA 1910 Exploring Symmetry Groups Mathematical discovery and invention in group theory: transformations, finite figures, strip patterns, wall patterns, finite groups, and Cayley diagrams. Develops the ability to find and describe patterns, to generalize from observations, to formulate conjectures, and to support conjectures with analysis and, when possible, formal proof. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Fall; offered alternate years beginning with the 2001–01 academic year

MA 1920 Exploring Knots and Surfaces Mathematical discovery and invention in topological graph theory: networks, graphs, graph coloring, surfaces and graphs, and knots. Develops the ability to find and describe patterns, to generalize from observations, to formulate conjectures, and to support conjectures with analysis and, when possible, formal proof. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Fall; offered alternate years beginning with the 2001–02 academic year

MA 1930 Exploring Number Theory Mathematical discovery and invention in number theory: number puzzles, Chinese Remainder Theorem, codes, primitive roots, and quadratic reciprocity. Develops the ability to find and describe patterns, to generalize from observations, to formulate conjectures, and to support conjectures with analysis and, when possible, formal proof. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Fall; offered alternate years beginning with the 2003–04 academic year

MA 1940 Exploring Non-Euclidean Geometry Mathematical discovery and invention in Non-Euclidean geometry: definitions of straight and angle, transformations, congruence, parallel transport, projections, and finite geometries. Develops the ability to find and describe patterns, to generalize from observations, to formulate conjectures, and to support conjectures with analysis and, when possible, formal proof. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Fall

MA 2010 Recreational Mathematics Topics include such things as fair division, maze threading, logic puzzles and paradoxes, famous math problems and solutions, cryptarithms, puzzles, how to use and misuse maps, mathematical humor, symmetry and coloring as problem-solving strategies, error-correcting codes, some transfinte arithmetic, and topology of compact surfaces. Credits: 2.0 Lec-Rec-Lab: (0-2-0) Semesters Offered: Spring; offered alternate years beginning with the 2001–02 academic year

MA 2150 Calculus II Continued study of calculus. Topics include applications of the integral, inverse functions, techniques of integration, sequences, and series. Credits: 4.0 Lec-Rec-Lab: (0-4-0) Semesters Offered: Fall Spring Summer Prerequisites: MA 1150 or MA 1160 or MA 1135

MA 2160 Calculus with Technology II Continued study of calculus, which includes a computer laboratory. Topics include integration and its uses, function approximation, vectors, and elementary modeling with differential equations. Credits: 4.0 Lec-Rec-Lab: (0-4-0) Semesters Offered: Fall Spring Summer Prerequisites: MA 1150 or MA 1160 or MA 1135

MA 2310 Applied Linear Algebra Lab Applications of linear algebra. Topics may include circuits, computer graphics, data fitting, difference equations, dynamical systems, Markov chains, structures, and vibrations. The lab includes an introduction to standard linear algebra software, such as MATLAB or Mathematica. Credits: 1.0 Lec-Rec-Lab: (0-0-1) Semesters Offered: On Demand Prerequisites: MA 2320(C) or MA 2330(C)

MA 2320 Elementary Linear Algebra Introduction to linear algebra and how it can be used, including basic mathematical proofs. Topics include systems of equations, vectors, matrices, orthogonality, subspaces, and the eigenvalue problem. Not open to students with credit in MA2350. Credits: 2.0 Lec-Rec-Lab: (0-2-0) Semesters Offered: Fall Spring Summer Restrictions: May not be enrolled in one of the following Major(s): Computer Science Mathematics Prerequisites: MA 1150 or MA 1160

MA 2330 Honors Elementary Linear Algebra Introduction to linear algebra and how it can be used, including basic mathematical proofs. Topics include systems of equations, vectors, matrices, orthogonality, subspaces, and the eigenvalue problem. Not open to students with credit in MA 2720 or MA 3710. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Spring

MA 2710 Introduction to Statistical Analysis Introduction to statistical reasoning and methods. Topics include uses and abuses of statistics, sources of data and data quality, graphical and descriptive methods, correlation and regression, probability and statistical inference. Labs involve data generation and analysis aided by statistical software. Not open to students with credit in MA 2720 or MA 3710. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Spring

MA 2720 Statistical Methods Introduction to the design and analysis of statistical studies. Topics include methods of data collection, descriptive and graphical methods, probability, statistical inference on means, regression and correlation, and single variable ANOVA. Not open to students with credit in MA3710. Credits: 4.0 Lec-Rec-Lab: (0-4-0) Semesters Offered: Fall Spring Restrictions: May not be enrolled in one of the following Major(s): Mathematics Prerequisites: MA 1032 or MA 1033

MA 2910 Mathematics Laboratory Mathematical discovery and invention in topics such as algebra, analysis, applied mathematics, discrete mathematics, geometry, and statistics. Class projects require students to find and describe patterns, generalize from observations, formulate and support conjectures with analysis and, when possible, formal proof. Projects require written reports describing the student’s findings, conjectures, and conclusions. Credits: 3.0 Lec-Rec-Lab: (0-2-2) Semesters Offered: Spring

MA 2920 Mathematical Problem Solving An introduction to problem-solving techniques in mathematics, including analogy, induction, “without loss of generality” arguments, working backwards, specialization and generalization, contradiction, decomposing and recombining. Much in-class time is devoted to solving problems from mathematical domains such as geometry, number theory, probability, topic, and set theory. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Spring; offered alternate years beginning with the 2001–02 academic year

MA 2990 Elementary Topics in Mathematics Students study a particular area in mathematics ordinarily not covered in existing courses. Intended for first- or second-year students. Credits: variable to 4.0; repeatable to a max of 6 Lec-Rec-Lab: (0-0-0) Semesters Offered: Fall Spring Restrictions: Permission of instructor required

MA 3150 Multivariable Calculus Introduction to calculus in two and three dimensions. Topics include conic sections, vectors, lines, planes, vector-valued functions, partial derivatives, multiple integrals, and calculus of vector fields. Completion of MA 2330 or MA 2320 recommended. Credits: 4.0 Lec-Rec-Lab: (0-4-0) Semesters Offered: Fall Spring Summer Prerequisites: MA 2150 or MA 2160

MA 3160 Multivariable Calculus with Technology Introduction to calculus in two and three dimensions, which includes a computer laboratory. Topics include functions of several variables, partial derivatives, the gradient, multiple integrals; introduction to vector-valued functions and vector calculus, divergence, curl, and the integration theorems of Green, Stokes, and Gauss. Completion of MA 2330 or MA 2320 recommended. Credits: 4.0 Lec-Rec-Lab: (0-4-0) Semesters Offered: Fall Spring Summer Prerequisites: MA 2150 or MA 2160

MA 3202 Introduction to Coding Theory Transmission via noisy channels, hamming distance, linear codes, the ISBN-code, encoding and decoding, finite fields, Reed-Solomon codes, deep space communication, the compact disk code, sphere packing bound, hamming codes, decoding. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Fall Spring Prerequisites: MA 2320 or MA 2330 or permission of instructor

MA 3203 Introduction to Cryptography Topics include private-key cryptography, shift substitution, permutation and stream ciphers, cryptanalysis, perfect secrecy, public-key cryptography, and the RSA cryptosystem. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Spring Prerequisites: MA 2320 or MA 2330 or permission of instructor

MA 3210 Introduction to Combinatorics Topics include set theory, mathematical induction, integers, functions and relations, counting methods, recurrence relations, generating functions, permutations, combinations, principle of inclusion and exclusion, graphs (including planar graphs). Further possible topics are graph coloring, trees and cutsets, combinatorial designs, Boolean algebra. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Fall Prerequisites: MA 2320 or MA 2330

MA 3310 Introduction to Abstract Algebra An intuitive introduction to groups, rings, and fields. Topics include set theory, functions, integral domains, Euclidean algorithm, congruence relations, finite fields, polynomial rings, symmetry groups, permutations, subgroups, cyclic groups, isomorphisms, homomorphisms, isomorphisms, introduction to group actions, and Burnside enumeration. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Fall Prerequisites: MA 2320 or MA 2330

MA 3450 Introduction to Real Analysis Why calculus works: a careful study of the logical basis of calculus, with an emphasis on how to read and write proofs. Topics include set theory, real numbers, infinite sequences, continuity, derivatives and integrals for functions of one variable, sequences of functions, infinite series. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Spring Prerequisites: MA 2150 or MA 2160

MA 3510 Applied Differential Equations Lab Applications of differential equations. Topics
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Description</th>
<th>Prerequisites</th>
<th>Credits</th>
<th>Lec-Rec-Lab</th>
</tr>
</thead>
<tbody>
<tr>
<td>MA 3520</td>
<td>Elementary Differential Equations</td>
<td>First order equations, linear equations, and systems of equations. Not open to students with credit in MA 3530 or MA 3560.</td>
<td>Credits: 3.0 Lec-Rec-Lab (0-3-0) or MA 3520 or MA 3560</td>
<td>3.0</td>
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<tr>
<td>MA 3530</td>
<td>Introduction to Differential Equations</td>
<td>First order equations, linear equations, systems of equations, and Laplace transforms. May include elementary separation of variables for partial differential equations. Not open to students with credit in MA 3520 or MA 3560.</td>
<td>Credits: 3.0 Lec-Rec-Lab (0-3-0) or MA 3520 or MA 3560</td>
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<td>(0-3-0)</td>
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<tr>
<td>MA 3560</td>
<td>Mathematical Modeling</td>
<td>Creating differential equation models for physical problems such as population dynamics, kinetics, mass-spring systems. Topics include non-dimensionalization, numerical methods, path-plane analysis, first-order systems, linearization, and stability. Includes modeling case studies, using a computer algebra system, and a modeling project. Not open to students with credit in MA 3520 or MA 3560.</td>
<td>Credits: 3.0 Lec-Rec-Lab (0-3-0) or MA 3520 or MA 3560</td>
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<td>(0-3-0)</td>
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<tr>
<td>MA 3710</td>
<td>Engineering Statistics</td>
<td>Introduction to the design, conduct, and analysis of statistical studies aimed at solving engineering problems. Topics include methods of data collection, descriptive and graphical methods, probability and probability models, statistical inference, control charts, design of experiments. Not open to students with credit in MA 2720.</td>
<td>Credits: 3.0 Lec-Rec-Lab (0-3-0) or MA 3520 or MA 3560</td>
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<td>MA 3720</td>
<td>Probability</td>
<td>Introduction to probabilistic methods. Topics include probability laws, distribution theory, and limit theorems; elementary statistics, parameter estimation, reliability; introduction to random processes and their properties.</td>
<td>Credits: 3.0 Lec-Rec-Lab (0-3-0) or MA 3520 or MA 3560</td>
<td>3.0</td>
<td>(0-3-0)</td>
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<tr>
<td>MA 3730</td>
<td>Survey Methods Data Analysis</td>
<td>Part I: Design and analysis of sample surveys. Part II: Analysis of data from case studies in various fields of application, using the statistical package SAS for data management, graphics, and statistical analysis. Emphasizes descriptive and graphical analysis, applications of statistical concepts and techniques, and report writing.</td>
<td>Credits: 3.0 Lec-Rec-Lab (0-3-0) or MA 3520 or MA 3560</td>
<td>3.0</td>
<td>(0-3-0)</td>
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<tr>
<td>MA 3810</td>
<td>Theory of Interest</td>
<td>Covers measurement of interest, including accumulated and present values, nominal and effective rates of interest and discount. Annuities certain, including continuous increasing and decreasing cases. Calculation of yield rates, amortization schedules, and sinking funds. Introduction to securities, duration and immunization of cash flows, and options pricing.</td>
<td>Credits: 3.0 Lec-Rec-Lab (0-3-0) or MA 3520 or MA 3560</td>
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<tr>
<td>MA 3924</td>
<td>College Geometry with Technology</td>
<td>Review of Euclidean geometry. Introduction to geometric constructions, conjecturing of theorems, methods of proof, 3-D geometry, finite geometries, and non-Euclidean geometries. Integrates computer software (e.g. Geometer’s Sketchpad) throughout the course.</td>
<td>Credits: 3.0 Lec-Rec-Lab (0-2-1) or MA 3520 or MA 3560</td>
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<tr>
<td>MA 3930</td>
<td>Theory of Games</td>
<td>Optimal and best strategies for finite 2-person games of strategy. Psychology of game playing. Bluffing, bargaining, threats, coalitions. Applications to warfare, economics, sociology, politics, and everyday life.</td>
<td>Credits: 3.0 Lec-Rec-Lab (0-3-0) or MA 3520 or MA 3560</td>
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<tr>
<td>MA 4028</td>
<td>Optimization and Graph Algorithms</td>
<td>An introduction to linear and integer programming and related graph problems. Topics include simplex algorithm, duality, branch-and-bound and branch-and-cut, shortest paths, spanning trees, matchings, network flow, graph coloring, and perfect graphs.</td>
<td>Credits: 3.0 Lec-Rec-Lab (0-3-0) or MA 3520 or MA 3560</td>
<td>3.0</td>
<td>(0-3-0)</td>
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<tr>
<td>MA 4029</td>
<td>Combinatorics and Graph Theory</td>
<td>An introductory course in combinatorics and graph theory. Topics include designs, enumeration, extremal set theory, finite geometry, graph coloring, inclusion-exclusion, network algorithms, permutations, and trees.</td>
<td>Credits: 3.0 Lec-Rec-Lab (0-3-0) or MA 3520 or MA 3560</td>
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<td>MA 4040</td>
<td>Applied Wavelet Analysis</td>
<td>Topics include review of Fourier transform, continuous wavelet transform, multiresolution analysis, discrete wavelet transform, wavelet analysis of 1-D and 2-D signals, nonparametric estimation with wavelets, data compression by wavelet shrinkage, exploratory wavelet analysis, wavelet packet analysis, cosine packet analysis, variations on wavelet analysis, boundary conditions for wavelet analysis.</td>
<td>Credits: 3.0 Lec-Rec-Lab (0-3-0) or MA 3520 or MA 3560</td>
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<td>(0-3-0)</td>
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<tr>
<td>MA 4041</td>
<td>Complex Variables</td>
<td>A study of complex numbers, functions of a complex variable, analytic functions, elementary functions, integrals, Taylor and Laurent series, residues and poles, and conformal mapping.</td>
<td>Credits: 3.0 Lec-Rec-Lab (0-3-0) or MA 3520 or MA 3560</td>
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<td>(0-3-0)</td>
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<tr>
<td>MA 4042</td>
<td>Differential Geometry</td>
<td>Geometrical properties of curves and surfaces, including the Frenet formulas, natural equations of curves, first and second fundamental forms, normal and Gaussian curvature, lines of curvature, geodesics, covariant derivatives, and parallel displacement. Tensors or differential forms with possible applications to Riemannian geometry, general relativity or other physical applications.</td>
<td>Credits: 3.0 Lec-Rec-Lab (0-3-0) or MA 3520 or MA 3560</td>
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<td>MA 4045</td>
<td>Real Analysis</td>
<td>Real analysis on Euclidean n-space. Topics include real and vector valued functions, metric and normed linear spaces; an introduction to Lebesgue measure and convergence theorems.</td>
<td>Credits: 3.0 Lec-Rec-Lab (0-3-0) or MA 3520 or MA 3560</td>
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<tr>
<td>MA 4051</td>
<td>Introduction to Partial Differential Equations</td>
<td>An introduction to solution techniques for linear partial differential equations. Topics include: separation of variables, eigenvalue and boundary value problems, spectral methods, and Green’s functions. Studies applications in heat and mass transfer (diffusion eqn.), and mechanical vibrations (wave and beam eqns.).</td>
<td>Credits: 3.0 Lec-Rec-Lab (0-3-0) or MA 3520 or MA 3560</td>
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<tr>
<td>MA 4210</td>
<td>Information Theory and Data Compression</td>
<td>Introduction to information theory and data compression. Topics include information and entropy, channel and channel capacity, Kraft-McMillan inequality, maximum likelihood decoding, reliability, Shannon’s theorem, lossless data compression, arithmetic coding, higher order modeling, adaptive methods, dictionary methods, transform methods, and image compression.</td>
<td>Credits: 3.0 Lec-Rec-Lab (0-3-0) or MA 3520 or MA 3560</td>
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<td>MA 4211</td>
<td>Aerodynamics</td>
<td>A mathematical study of the fundamental principles of wavelets. Topics include review of Fourier transform, continuous wavelet transform, multiresolution analysis, discrete wavelet transform, wavelet analysis of 1-D and 2-D signals, nonparametric estimation with wavelets, data compression by wavelet shrinkage, exploratory wavelet analysis, wavelet packet analysis, cosine packet analysis, variations on wavelet analysis, boundary conditions for wavelet analysis.</td>
<td>Credits: 3.0 Lec-Rec-Lab (0-3-0) or MA 3520 or MA 3560</td>
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aerodynamics. Topics include elements of complex variable techniques, two-dimensional potential flow theory, vorticity and circulation, lift and drag forces, pitching moment, and analysis of two-dimensional airfoils. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Spring; offered alternate years beginning with the 2001–02 academic year Prerequisites: (MA 2320 or MA 2330) and (MA 3150 or MA 3160)

MA 4550 Mathematical Models in Biometrics Mathematical models from biology, biophysics, biomedical engineering, medicine, and ecology. Models may include human physiology (heart, lung, brain, bones), population models (microorganisms, cells, animals), and diagnosis and treatment of disease (heart, cancer). Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Fall; offered alternate years beginning with the 2001–02 academic year Prerequisites: (MA 2320 or MA 2330) and (MA 3150 or MA 3160) or permission of instructor

MA 4555 Derivative Securities Models Mathematical models to price-derivative securities, stochastic calculus. Computational methods for computing option prices. May include study of mathematical models of risk analysis, portfolio selection theory, futures, options, and instrument derivative investment instruments. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Spring; offered alternate years beginning with the 2000–01 academic year Prerequisites: (MA 2320 or MA 2330) and (MA 3150 or MA 3160)

MA 4610 Numerical Linear Algebra Derivation and analysis of algorithms for problems in linear algebra. Covers floating point arithmetic, condition numbers, error analysis; solution of linear systems (direct and iterative methods), eigenvalue problems, least squares, singular value decomposition. Includes a review of elementary linear algebra and the use of MATLAB or software from NETLIB. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Spring Prerequisites: MA 2320 or MA 2330

MA 4620 Finite Difference Methods and PDEs Derivation, analysis, and implementation of finite difference methods; applications to fluid mechanics, elasticity, heat conduction, acoustics, or electromagnetism. Difference equations, Taylor series, stability, convergence; Runge-Kutta, multistep methods, etc., stiff systems. Finite difference methods for partial differential equations; alternate methods for discretizing space, such as spectral, finite element, or particle methods. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Fall Prerequisites: MA 3520 or MA 3530 or MA 3650 and (MA 3150 or MA 3160) or permission of instructor

MA 4625 Finite Element Methods Theory and practical applications of finite element methods in fluid mechanics, elasticity, heat transfer, and electricity and magnetism. Topics include variational principles, elementary function spaces, finite element methodology, convergence, errors, and element selection. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Spring Prerequisites: MA 3520 or MA 3530 or MA 3650 and (MA 3150 or MA 3160) or permission of instructor

MA 4630 Computational Industrial Math I Methods for solving industrial and financial problems involving linear and nonlinear systems, eigen analysis, discrete and numerical calculus, splines, mathematical models, well-posed problems and well-conditioned algorithms, stability and forward- and backward-error analyses, digital computer arithmetic, round-off error, program design and development and debugging applications, simulations, efficacy, fidelity tests. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Fall Prerequisites: MA 3150 or MA 3160 or permission of instructor

MA 4631 Computational Industrial Math II Methods for solving industrial and financial problems involving function approximation, data representation, curve fitting, constrained and unconstrained optimization, linear and nonlinear programming, ordinary and partial difference and differential equations, stability, convergence, consistency, well-posed problems and well-conditioned algorithms, finite methods X = Ax + b, difference, element, first-principles, interpolations, volume. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Spring Prerequisites: MA 4630 and (MA 3520 or MA 3530 or MA 3650) or permission of instructor

MA 4635 Numerical Methods for Integral Equations Includes quadrature and quadrature methods for solving integral equations that occur in many scientific disciplines (imagery, aerodynamics, etc.). Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Fall; offered alternate years beginning with the 2000–01 academic year Prerequisites: (MA 2320 or MA 2330) and (MA 3150 or MA 3160)

MA 4710 Regression Analysis Covers simple, multiple, and polynomial regression, estimation, testing, and prediction; weighted least squares, matrix approach, dummy variables, multicollinearity, model diagnostics and variable selection. A statistical computing package is an integral part of the course. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Spring Prerequisites: MA 2720 or MA 3710 or MA 2710

MA 4720 Design and Analysis of Experiments Covers construction and analysis of completely randomized, randomized block, incomplete block, Latin squares, factorial, fractional factorial, nested and split-plot designs. Also examines fixed, random and mixed effects models and multiple comparisons and contrasts. The SAS statistical package is an integral part of the course. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Fall Prerequisites: MA 2720 or MA 3710 or MA 2710

MA 4760 Mathematical Statistics I Covers probability set functions and distributions, multivariate distributions, special distributions, distributions of functions of random variables, and limiting distributions. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Fall; offered alternate years beginning with the 2000–01 academic year Prerequisites: MA 3720

MA 4770 Mathematical Statistics II Point estimation, confidence intervals, sufficient statistics, Bayesian estimation, the Rao-Cramer inequality, hypothesis testing, including optimal tests, nonparametric methods. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Spring; offered alternate years beginning with the 2000–01 academic year Prerequisites: MA 4760

MA 4810 Life Contingencies Measurement of mortality, life tables, commutation functions. Covers all basic forms of life insurance and life annuities, including gross and not premiums, reserves, cash values, and expense loadings. Advanced topics may include stationary populations, joint and multiple life functions, multiple decrement tables and dividends. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Spring Prerequisites: MA 3720 or MA 3810

MA 4820 Loss Distributions and Credibility Theory Credibility theory addresses methods for updating statistical estimates as new data becomes available. Loss distribution studies probability distributions that are used for modeling the outcomes of insurance claims. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Fall; offered alternate years beginning with the 2001–02 academic year Prerequisites: (MA 3150 or MA 3160) and MA 3720

MA 4830 Risk Theory and Survival Models Individual and collective risk models as they apply to the economics of insurance. Nature and properties of parametric and tabular survival models, estimated from complete or incomplete data. Includes actuarial, moment and maximum likelihood estimation techniques, and applications and extension of models. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Spring; offered alternate years beginning with the 2001–02 academic year Prerequisites: (MA 3150 or MA 3160) and MA 3720

MA 4900 Mathematical Sciences Project Independent study in an area of mathematical sciences under the guidance of a faculty member. Credits: variable to 4.0; repeatable to a max of 6. Lec-Rec-Lab: (0-0-0) Semesters Offered: Fall Spring Restrictions: Permission of instructor required

MA 4908 Theory of Numbers with Technology Mathematical induction, Euclid’s algorithm, prime and composite integers, algebra of congruences, Chinese remainder theorem, quadratic reciprocity law, number theoretic functions, first degree Diophantine equations, Pythagorean triples, Fermat and Mersenne numbers, factoring algorithms, tests for primality and various applications. Projects use Mathematica and EXCEL software packages. Credits: 3.0 Lec-Rec-Lab: (0-2-2) Semesters Offered: Spring Prerequisites: MA 3160

MA 4945 History of Mathematics Survey of the development of mathematics from ancient times to today. How cultural, mathematical, and technological developments have influenced one another throughout history. Course provides all necessary historical background. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Fall Prerequisites: MA 3150 or MA 3160

MA 4990 Topics in Mathematics Students study in greater depth a particular area of mathematics not studied in existing courses. Credits: variable to 4.0; repeatable to a max of 6. Lec-Rec-Lab: (0-0-0) Semesters Offered: Fall Spring Restrictions: Permission of instructor required

Mathematics Technology (MAT)

MAT 0111 Introductory Algebra and Trigonometry Designed for students whose preparation is not sufficient for MAT111. Includes arithmetic fundamentals, fractions, decimals, geometry, graphing, algebra fundamentals, equations, problem solving, quadratic equations, proportions and trigonometry. Requires a TI-85 calculator. Credits do not count toward graduation. Credits: 5.0 Lec-Rec-Lab: (0-5-0) Semesters Offered: Fall Spring

MAT 1115 Technical Mathematics I An intermediate course in algebra and trigonometry. Examples emphasize applications of engineering technology. Requires a TI-85 calculator. Requires an ACT math score >18 or SAT math score >450 or MAT0111 or permission of instructor. Credits: 5.0 Lec-Rec-Lab: (0-5-0) Semesters Offered: Fall Spring Restrictions: Must be enrolled in one of the following College(s): School of Business/Economics, School of Technology

MAT 1125 Technical Mathematics II A course in complex numbers, exponential and logarithmic functions, matrix operations, trigonometric identities and trigonometric equations, analytic geometry, basic statistics, derivatives and applications of derivatives. Examples will emphasize applications. Requires a TI-85 calculator. Credits: 5.0 Lec-Rec-Lab: (0-5-0) Semesters Offered: Fall Spring Restrictions: Must be enrolled in one of the following College(s): School of Business/Economics, School of Technology Prerequisites: MAT 1115 or MA 1032 or MA 1033 or permission of instructor

MAT 2215 Technical Mathematics III A course in integration, applications of integration, differentiation of transcendental functions and methods of integration. Examples emphasize applications. Requires a TI-85 calculator. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Fall Spring Restrictions: Must be enrolled in one of the following College(s): School of Business/Economics, School of Technology Prerequisites: MAT 1115 or MA 1135 or MA 1150 or permission of instructor

MAT 3225 Technical Mathematics IV A course in methods of integration, series methods, solution methods for first and second order differential equations, including Laplace transforms and applications of differential equations. Examples emphasize applications. Requires a TI-85 calculator. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Spring Restrictions: Must be enrolled in one of the following College(s): School of Business/Economics, School of Technology Prerequisites: MAT 2215 or MA 2150 or permission of instructor
MEEM 2110 Statics — Force systems in two and three dimensions. Includes composition and resolution of forces and force systems, principles of equilibrium applied to various bodies, simple structures, friction, centroids, and moments of inertia. Vector algebra used where appropriate. Credits: 3.0 Lec-Rec-Lab: (2-1-0) Semesters Offered: Fall Spring

MEEM 211D Statics for Design (Distance Program) — Force systems in two and three dimensions. Includes composition and resolution of forces and force systems, principles of equilibrium applied to various bodies, simple structures, friction, centroids, and moments of inertia. Vector algebra used where appropriate. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Fall Semesters Offered: Fall Spring

MEEM 2120 Statics-Strength of Materials — The composition and resolution of forces and force systems, principles of equilibrium applied to various bodies, simple structures, friction, and centroids of area. Introduction to the mechanical behavior of materials, including calculation of stresses, strains, and deformations due to axial, torsional, and flexural loading. Credits: 4.0 Lec-Rec-Lab: (0-4-0) Semesters Offered: Fall Spring

MEEM 2150 Mechanics of Materials — Introduction to mechanical behavior of materials, including stress/strain at a point, principle stresses and strains, stress-strain relationships, determination of stresses and deformations in situations involving axial loading, torsional, and flexural loading of circular cross-sections. Credits: 3.0 Lec-Rec-Lab: (3-0-3) Semesters Offered: Fall Spring

MEEM 2151D Mechanics of Materials for Design (Distance Program) — Introduction to mechanical behavior of materials, including stress/strain at a point, principle stresses and strains, stress-strain relationships, determination of stresses and deformations in situations involving axial loading, torsional, and flexural loading of circular cross-sections. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Spring

MEEM 2200 Thermodynamics — Introduces fundamental concepts of heat and power. Presents property relationships for solids, liquids, and gases. Applies the first and second laws of thermodynamics to the analysis of processes for open and closed systems. Also discusses cycles. Credits: 3.0 Lec-Rec-Lab: (3-0-3) Semesters Offered: Fall Spring

MEEM 2500 Integrated Design Manufacturing — Focuses on practical aspects of design and manufacturing. Covers fundamentals of manufacturing processes and includes weekly lab providing hands-on experiences with manufacturing issues that influence component design. Uses computer-aided design (CAD) and computer-aided manufacturing (CAM) tools throughout. Credits: 4.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Fall Spring

MEEM 2700 Dynamics — First course in the principles of dynamics, covering the motion of a particle, the kinematics and kinetics of plane motion of rigid bodies, the principles of work and energy, impulse and momentum. Uses vector methods. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Fall Spring

MEEM 3000 Mechanical Engg Laboratory — Presents basic laboratory skills, including analog and digital data acquisition, transducer selection and calibration, laboratory safety, and application of statistical principles to experimental data. Presents concept of investigating phenomenon through observation and interpretation of acquired data. Reinforces concepts in statics, strength of materials, thermodynamics, fluid mechanics, and dynamics. Credits: 2.0 Lec-Rec-Lab: (0-1-3) Semesters Offered: Fall Spring

MEEM 3210 Fluid Mechanics — Presentation/development of the fundamentals of fluid dynamics, building on students’ background in mechanics and thermodynamics. Makes applications to fluid statics, incompressible flows with friction (viscosity) and compressible flows without friction. Covers nondimensional representation of experimental results, power requirements for pumps and turbines, and energy losses in pipes. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Fall Spring

MEEM 3220 Energy Laboratory — Introduction to transducers and the use of transducers to reinforce knowledge in the application of the principles of thermodynamics, fluid mechanics, and heat transfer. Credits: 1.0 Lec-Rec-Lab: (0-9-3) Semesters Offered: Fall Spring

MEEM 3230 Heat Transfer — Covers fundamental principles of steady-state and transient heat transfer, including conduction, convection, and radiation. Also covers applications to heat exchangers and extended surfaces. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Fall Spring

MEEM 3501 Product Realization I — Students apply mechanical synthesis, analysis, and manufacturing processes to the design of products, using case studies of existing products to develop the relationships between design, manufacturing, and product performance. They apply synthesis methods to the design of a new product. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Fall Spring

MEEM 3502 Product Realization II — Students apply design and manufacturing principles to a complete mechanical system, using synthesis and analysis software, SPC, design for manufacturing, and assembly techniques in the redesign of various consumer products. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Fall Spring

MEEM 3700 Mechanical Vibrations — Dynamic behavior of single degree-of-freedom systems. Free and forced vibration with an emphasis on harmonic motion. Vibration considerations in design; vibration isolation, balancing, and transmissibility. Free and forced vibration of multiple degree-of-freedom systems. Laplace transform solutions for periodic and transient inputs. Introduction to system modeling. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Fall Spring

MEEM 4150 Internal Mechanics of Materials — Basic concepts of three-dimensional stress and strain. Inelastic behavior of creep, fracture, circular shafts, and symmetric beams. Deflections of indeterminate beams. Asymmetrical bending, shear flow and shear center for open sections. Energy methods for structures made up of one-dimensional elements. Introduction to theories of failures for anisotropic materials. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Fall Spring

MEEM 4160 Fund of Exp Stress Analysis — Transmits basic understanding of purposes and uses of experimental stress analysis and makes students familiar with methods used in the field to give experience in either design or analysis of strain-gauged transducer. Credits: 3.0 Lec-Rec-Lab: (0-2-3) Semesters Offered: Fall Spring

MEEM 4170 Failure of Mat'l in Mechanics — Identifies the modes of mechanical failure that are essential to prediction and prevention of mechanical failure. Discusses more important failure modes in detail. Treats the topic of fatigue failure extensively with attention to both high-cycle and low-cycle range of fatigue. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Spring

MEEM 4180 Biomechanics — Mechanics applied to the human body in health and disease or injury, which includes mechanics of human biological materials and musculo-skeletal system. Also studies mechanics of posture (occupational biomechanics) and locomotion (sports biomechanics) using mathematical models of the human body. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Spring

MEEM 4200 Principles of Energy Converters — Introduces basic background, terminology, and fundamentals of energy conversion. Discusses current and emerging technologies for production of thermal, mechanical, and electrical energy. Main topics include the use of fossil and nuclear fuels, solar energy, and steam turbine power plants, hydraulic and wind turbines, fuel cells, and solar cells. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Fall Spring

MEEM 4210 Comp Methods in Thermal Sci — Introduces computational methods used to solve thermodynamic, fluid mechanic, and heat transfer problems. Discusses theoretical and practical aspects. Modern computational tools are used to reinforce principles and introduce advanced topics in thermodynamics, fluid mechanics, and heat transfer. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Fall Spring

MEEM 4220 Internal Combustion Engines I — Teaches the operation and design of various types of internal combustion engines through the application of applied thermodynamics, cycle analysis, combustion, mixtures of gases, fluid dynamics, and heat transfer. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Fall Spring

MEEM 4240 Combustion Air Pollution — Introduces physical-chemical processes of combustion, including the phenomena of ignition, extinction, flame propagation, detonation, solid propellant combustion, fuel spray combustion, and pollutant formation. Also addresses analysis and design of an air pollution control system with a special focus on automotive emissions. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Spring

MEEM 4250 Heating/Ventilation/Air Cond — Elements of heat transfer for buildings. Thermodynamic properties of moist air, human comfort and the environment, solar energy fundamentals and applications, water vapor transmission in building structures, heating and cooling load calculations. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Spring
MEEM 4403 Computer-Aided Design Methods Students apply fundamental and intermediate geometric modeling techniques to construct solid models of mechanical components, assemble them into a system, and document the system's design. Students use shared data to function in a concurrent design environment and identify major functional features of commercially available geometric modeling software. Credits: 4.0 Lec-Rec-Lab: (3-0-3) Semesters Offered: Fall. Spring Restrictions: Must be enrolled in one of the following College(s): College of Engineering Prerequisites: ENG 1102

MEEM 4403D Computer-Aided Design Methods (Distance Program) Students apply fundamental and intermediate geometric modeling techniques to construct solid models of mechanical components, assemble them into a system, and document the system's design. Students use shared data to function in a concurrent design environment and identify major functional features of commercially available geometric modeling software. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Fall. Spring Restrictions: Must be enrolled in one of the following College(s): College of Engineering Prerequisites: ENG 1102

MEEM 4404 Mechanism Syn/Dynamic Modeling Students apply kinematic synthesis techniques in design and analysis of mechanical systems. They develop synthesis software to link to dynamic analysis packages such as ADAMS, I-DEAS, Unigraphics, etc. They investigate influences of process variation on system output and learn methods to minimize the variation influences. Credits: 4.0 Lec-Rec-Lab: (3-0-3) Semesters Offered: Fall. Spring. Prerequisites: MEEM 3502(C)

MEEM 4404D Mechanism Syn/Dynamic Modeling (Distance Program) Students apply kinematic synthesis techniques in design and analysis of mechanical systems. They develop synthesis software to link to dynamic analysis packages such as ADAMS, I-DEAS, Unigraphics, etc. They investigate influences of process variation on system output and learn methods to minimize the variation influences. Credits: 3.0 Lec-Rec-Lab: (3-0-3) Semesters Offered: Fall. Spring. Prerequisites: MEEM 3502(C)

MEEM 4405 Intro to Finite Element Method Introduces the use of the finite element method in stress analysis and heat transfer. Emphasizes the modeling assumptions associated with different elements and uses the computer to solve many different types of stress analysis problems, including thermal stress analysis and introductory nonlinear analysis. Credits: 3.0 Lec-Rec-Lab: (0-2-2) Semesters Offered: Fall. Spring. Prerequisites: MEEM 3502 and MA 2230 and MA 3520

MEEM 4610 Advanced Machining Processes Covers mechanics of machining processes, oblique cutting processes, heat transfer in machining, machining of brittle materials, dynamics of multipoint cutting, nontraditional machining processes. Credit may not be received for both MEEM 4610 and MEEM 5610. Credits: 3.0 Lec-Rec-Lab: (0-2-2) Semesters Offered: Spring. Prerequisites: MEEM 2500

MEEM 4613 Metal Forming Processes Covers analytical and experimental study of metal forming processes, such as forging, extrusion, rolling, bending, stretch forming, and deep drawing as well as progressive die design for sheet metal stamping and design of dies for bulk forming. Credits: 4.0 Lec-Rec-Lab: (0-3-2) Semesters Offered: Fall. Prerequisites: MEEM 2500 and MEEM 2150

MEEM 4615D Metal Forming Processes (Distance Program) Covers analytical and experimental study of metal forming processes, such as forging, extrusion, rolling, bending, stretch forming, and deep drawing as well as progressive die design for sheet metal stamping and design of dies for bulk forming. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Fall. Prerequisites: MEEM 2500 and MEEM 2150

MEEM 4620 Metal Forming Cutting Mach Analysis and design of metal cutting and forming machines and subsystems to estimate part throughput, power requirements, thermal load, environmental influence, and precision. Includes to the characteristics and performance of actuation devices, feedback devices, and machine kinematics. Credits: 3.0 Lec-Rec-Lab: (0-2-2) Semesters Offered: Spring. Prerequisites: MEEM 3502(C)

MEEM 4625 Precision Manuf and Metrology Course presents theory and practice involved in manufacturing and measuring of precision components. Topics include precision machining processes, precision machine/mechanism design, and dimensional metrology. Also discusses current manufacturing challenges in the bearings, optics, and microelectronics industries. Credits: 3.0 Lec-Rec-Lab: (0-2-2) Semesters Offered: Spring. Prerequisites: MEEM 3500C and MEEM 3502.

MEEM 4635 Design with Plastics Covers various complexities in design of plastic parts and design of molds for manufacturing of plastic parts. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Fall. Prerequisites: MY 2100 and MEEM 2150

MEEM 4640 Micromanufacturing Processes Introduces the processes and equipment for fabricating microsystems and the methods for measuring component size and system performance. Fabrication processes include microscale milling, drilling, diamond machining, and lithography. Measurement methods include interferometry and scanning electron microscopy. Credits: 3.0 Lec-Rec-Lab: (0-2-2) Semesters Offered: Fall. Offered alternate years beginning with the 2000–01 academic year. Prerequisites: MEEM 3502(C)

MEEM 4650 Quality Engineering Introduction to the concepts and methods of quality and productively improvement. Topics include principles of Shewhart, Deming, Taguchi: meaning of quality; control charts for variables, individuals, and attributes; process capability analysis; variation of assemblies; and computer-based workshops. Credit may not be received for both MEEM 4650 and MEEM 5650. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Fall. Prerequisites: MA 3710

MEEM 4655 Production Planning Provides current issues, such as just-in-time production and reengineering, while covering fundamental production planning topics as scheduling, job design, inventory and forecasting. Provides the fundamental essence of the firm—how its products are made and how they are delivered to customers. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Fall. Prerequisites: MEEM 3501(C)

MEEM 4660 Data Based Modeling Control System modeling from observed data for computer-aided design and manufacturing, providing differential equation models. Analysis of manufacturing and dynamic systems, computer routines for modeling, forecasting with accuracy assessment, and minimum mean squared error control. Underlying system analysis, including stability and feedback interpretation, periodic and exponential trends, illustrative applications to real-life data. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Fall. Restrictions: Must be enrolled in one of the following Class(es): Senior.

MEEM 4665 Manufacturing System Simulation Provides concepts and techniques for the design of manufacturing systems with computer simulation programming. Emphasizes a teamwork approach to achieve the goal. Provides basic simulation programming techniques to design various production systems. Credits: 3.0 Lec-Rec-Lab: (0-2-2) Semesters Offered: Spring. Prerequisites: MEEM 3501(C)

MEEM 4675 Material Handling-Plant Layout Basic background in material handling and plant layout for manufacturing, assembly, or warehousing. Emphasis is between the formulation and application experience in system design, plant layout, methods for solving design problems, and practical design issues. Insight is gained into the application of engineering design principles, performance calculations, analysis, and management concepts. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Spring. Prerequisites: Must be enrolled in one of the following College(s): School of Business/Economics, College of Engineering; must be enrolled in one of the following Class(es): Senior.

MEEM 4685 Env Resp Design Manuf Examines the impact of engineering and design/manufacturing, decision on the environment. Topics include sustainability, energy and material flows, risk assessment, life cycles, manufacturing process waste streams, and product design issues, including disassembly and post-use product handling and techniques for pollution. A course project may be completed for one extra credit. Credits: variable to 4.0 Lec-Rec-Lab: (0-0-0) Semesters Offered: Spring. Restrictions: Must be enrolled in one of the following College(s): College of Engineering; must be enrolled in one of the following Class(es): Senior.

MEEM 4700 Dynamic Systems and Controls Analysis of dynamic systems, use of Laplace transforms to solve differential equations, design of control systems using classic and modern approaches, comparison of control methodologies, application and comparison of time- and frequency-domain specifications to design, basic system identification, digital implementation issues. Emphasizes practical design and application issues. Credits: 4.0 Lec-Rec-Lab: (0-3-2) Semesters Offered: Fall. Spring. Prerequisites: MEEM 3700

MEEM 4700D Dynamic Systems and Controls (Distance Program) Analysis of dynamic systems, use of Laplace transforms to solve differential equations, design of control systems using classic and modern approaches, comparison of control methodologies, application and comparison of time- and frequency-domain specifications to design, basic system identification, digital implementation issues. Emphasizes practical design and application issues. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Fall. Spring. Prerequisites: MEEM 3700

MEEM 4701 Analysis and Exp Modal Analysis Combined experimental and analytical approach to mechanical vibration issues; characterization of the dynamic behavior of a structure in terms of its modal parameters; digital data acquisition and signal processing; experimental modal analysis procedures; parameter estimation for obtaining modal parameters; model validation and correlation with analytical models; structural dynamics modification. Credits: 4.0 Lec-Rec-Lab: (0-3-2) Semesters Offered: Fall. Prerequisites: MEEM 3700

MEEM 4703 Intermediate Control Systems Develops classical and modern control system analysis and design techniques to apply to variety of dynamic systems. Topics include Bode, Nyquist, Nichols, root locus, controllability, observability, state feedback, observers, z-transform, and controller discretization. Places special emphasis on the control system process from system modeling, controller simulation and experimental implementation. Credits: 4.0 Lec-Rec-Lab: (0-3-2) Semesters Offered: Spring. Prerequisites: MEEM 4700

MEEM 4704 Acoustics and Noise Control Analysis and solution of practical environmental noise problems. Fundamental concepts of sound generation and propagation, the unwanted effects of noise, assessment of sound quality, and source-path-receiver concepts in noise control. Lecture, measurement laboratory, and team project directed at solving a real noise problem under a client's sponsorship. Credits: 3.0 Lec-Rec-Lab: (0-2-2) Semesters Offered: Spring. Prerequisites: MA 3160 and MEEM 2700

MEEM 4705 Automation and Robotics Describes automation equipment and processes, including programmable logic controller and introduction to robotics. Covers techniques for developing embedded microprocessor based systems in addition to machine vision fundamentals and applications. Introduces cost vs functionality analysis methods. Credits: 4.0 Lec-Rec-Lab: (0-3-3) Semesters Offered: Spring. Prerequisites: MEEM 2500
MEEM 4900 Senior Design I Introduces computer-aided design (CAD) methods, including the finite element method and computational fluid dynamics, as tools for engineering design. Senior projects are selected/assigned with initial concepts evaluated using CAD methods. Covers project management methods and emphasizes communications, oral, and written. Credits: 3.0 Lec-Rec-Lab: (2-0-3) Semesters Offered: Fall Spring Prerequisites: MEEM 3501

MEEM 4910 Senior Design II Design projects started in MEEM4900 are completed and evaluated using computer-aided engineering methods, physical models, and/or prototypes as appropriate. Introduces evaluation and design optimization methods, enabling students to develop efficient and cost-effective designs. Credits: 3.0 Lec-Rec-Lab: (1-0-6) Semesters Offered: Fall Spring Prerequisites: MEEM 4900

MEEM 4990 Special Topics in Mech Engg Problems in mechanical engineering, engineering mechanics, manufacturing, or industrial engineering that are not covered in regular courses. Credits: variable to 6.0; repeatable to a max of 6 Lec-Rec-Lab: (0-6-6) Semesters Offered: Fall Spring Summer Restrictions: Permission of department required; must be enrolled in one of the following Classes(1): junior Senior

MEEM 4991D Solid Modeling (Distance Program) Develops a working knowledge of parametric solid modeling techniques for building, modifying, and constraining virtual automotive components and assemblies, including the use of parametric constraints, feature creation and editing techniques, and development of free-form features. Credits: 6.0 Lec-Rec-Lab: (0-6-0) Semesters Offered: On Demand

MEEM 4992D Vehicle Packaging (Distance Program) Explores the designer’s role in vehicle packaging issues and practices, such as drive/passenger ergonomics, engine compartment serviceability, and clearance parameters; door, deck and hood requirements; suspension and exhaust system considerations; heating/cooling system provisions and limitations; and fuel system factors. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: On Demand Prerequisites: ME 4991D or ENG 1102

MEEM 4993D Design for Manufacturability (Distance Program) Provides the background and concepts needed to select and apply the various methodologies and techniques of Design for Manufacturability (DFM) to the design of automotive components and systems as a means of improving the manufacturing effectiveness, productivity, and reducing cost. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: On Demand Prerequisites: MEEM 2500

Electro/Mechanical Tech (MET)

MET 1540 Materials Science Introduction to the fundamentals of materials. Introduces mechanical properties, phase diagrams, thermal processing, alloying, and corrosion. Examines material selection with regard to design considerations. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Fall Spring Prerequisites: CH 1100 or permission of instructor

MET 2000 Power Transmission Introduction to the transmission and control of mechanical and fluid power for electromechanical and electrical engineering technology students. Classroom instruction together with hands-on lab experiences in the synthesis of various power transmission components and systems. Credits: 3.0 Lec-Rec-Lab: (0-2-3) Semesters Offered: Fall Spring Prerequisites: MAT 1115 and PH 1100 or permission of instructor

MET 2100 Factory Automation Introductory course for electromechanical and electrical engineering technology students covering manufacturing processes and the controls used in modern factory environments. Overview of the manufacturing enterprise and how various processes are controlled. Credits: 4.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Fall Spring Prerequisites: MAT 1115 or permission of instructor

MET 2120 Statics and Strength of Materials The statics portion includes the study of forces, analysis of simple structures, equilibrium, centroids and moment of inertia, and friction. The materials portion considers stress and strain under axial, torsional, and bending loads. Laboratory exercises include statics problem solving, materials testing, report writing, and a discussion of materials and testing standards. Credits: 4.0 Lec-Rec-Lab: (0-3-2) Semesters Offered: Fall Spring Prerequisites: MAT 1125(C) or permission of instructor

MET 2130 Dynamics Introduction to dynamics. Covers kinematics of rectilinear and curvilinear motion, work, energy and power analysis. Credits: 3.0 Lec-Rec-Lab: (0-0-3) Semesters Offered: Spring Prerequisites: MET 2120

MET 2153 Machine Tool Fundamentals and Applications A study of basic machining processes, including setup and operation of lathes, milling machines, drill presses, grinders and saws. Students are exposed to machining processes with integrated experiences in quality control and CAM. Credits: 2.0 Lec-Rec-Lab: (0-1-3) Semesters Offered: Fall Spring

MET 2242 Machine Design I Kinematic analysis of basic mechanisms with an introduction to kinematic synthesis. Dynamic balancing and computer-aided solutions. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Spring Prerequisites: MAT 2215 and MET 2120 or permission of instructor

MET 3131 Instrumentation I Investigation of physical systems using classical measurement techniques. Covers electrical sensors, digital and analog signal conditioning. Credits: 4.0 Lec-Rec-Lab: (0-2-2) Semesters Offered: Spring Prerequisites: EET 2311 or EET 2221 or permission of instructor

MET 3250 Applied Fluid Mechanics Introduction to the basic principles and applications of fluid mechanics for engineering technology students. Emphasizes design and evaluation of practical engineering systems. Credits: 4.0 Lec-Rec-Lab: (0-3-2) Semesters Offered: Fall Prerequisites: PH 1100 and MAT 3225 or permission of instructor

MET 3361 Applied Thermodynamics and Heat Transfer Introduction to the basic principles and applications of engineering thermodynamics and heat transfer for technology engineering students. Emphasizes design and evaluation of practical engineering systems. Credits: 4.0 Lec-Rec-Lab: (0-3-2) Semesters Offered: Fall Spring Prerequisites: MET 3250 or MAT 3225

MET 3450 Machine Design II Study of the fundamental principles of mechanical design on an elemental basis. Develops principles of statics and dynamics in the evolution of mechanical systems under static and dynamic loads. Credits: 4.0 Lec-Rec-Lab: (0-4-0) Semesters Offered: Fall Prerequisites: MET 2242 and MET 2130 or permission of instructor

MET 3650 Applied Finite Element Analysis Introduction to the finite element method with integration of validation techniques. Includes 1-D, 2-D, and solid elements. Applications made to structural, dynamic, thermal and fluid element models. Credits: 3.0 Lec-Rec-Lab: (0-2-3) Semesters Offered: Spring Prerequisites: MET 3450 or permission of instructor

MET 4131 Advanced Instrumentation Continuation of concepts introduced in MET3131. Covers transducer design, circuit simulation, data collection and data reduction; fundamentals of digital signal processing, including a treatment of fast Fourier transforms, cross correlation, and auto correlation. General introduction to computer-aided testing. Credits: 3.0 Lec-Rec-Lab: (0-2-2) Semesters Offered: Fall Spring Prerequisites: MET 3131 or permission of instructor

MET 4350 Heating, Ventilation and Air Conditioning Introduction to the principles and applications of HVAC engineering for technology students. Emphasizes design and evaluation of practical engineering systems. Credits: 3.0 Lec-Rec-Lab: (0-2-2) Semesters Offered: Fall Spring Prerequisites: MET 3361 or permission of instructor

MET 4375 Applied Energy Systems Expands on the applications of energy systems covered in MET3361. Emphasizes practical approaches to efficient energy management using system evaluations and design projects. Credits: 3.0 Lec-Rec-Lab: (0-2-2) Semesters Offered: Fall Spring Prerequisites: MET 3361 or permission of instructor

MET 4390 Internal Combustion Engines Introduction to the principles of internal combustion system design, development, and testing for engineering technology students. Emphasizes design and evaluation of practical engineering systems. Credits: 3.0 Lec-Rec-Lab: (0-2-2) Semesters Offered: Fall Spring Prerequisites: MET 3361 or permission of instructor

MET 4400 Manufacturing Simulation Introductory course in computer integrated manufacturing. Covers computer interfaces of machine tools, process and overall integration of enterprise-wide manufacturing systems. Discusses group technology, economic analysis, and quality metrics. Credits: 3.0 Lec-Rec-Lab: (0-2-2) Semesters Offered: Fall Spring Prerequisites: MA 2710 or permission of instructor

MET 4450 Manufacturing Process Introduction to the mechanics of several manufacturing processes and nontraditional manufacturing processes and examinations of metal forming and machining. Several plant trips will be made to local manufacturers. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Spring Prerequisites: MET 1540 and MET 2120 or permission of instructor

MET 4460 Product Design and Development A treatment of design and development issues such as design for manufacturing, prototyping, industrial design, and customer needs. Presents integrated methodologies that examine marketing, manufacturing, and cross-functional teams. Includes concurrent engineering and projects utilizing CAD systems. Credits: 3.0 Lec-Rec-Lab: (0-2-2) Semesters Offered: Fall Spring Prerequisites: MET 3650 or permission of instructor

MET 4570 Senior Project I First of two courses that introduce a student to a research and design experience in which full documentation is maintained by the student. Includes written and oral reports, peer reviews, and teaming. Emphasizes the use of computers. Credits: 3.0 Lec-Rec-Lab: (0-0-6) Semesters Offered: Spring Prerequisites: MET 3650 or permission of instructor

MET 4670 Senior Project II Continuation of MET4570. Involves design reviews, teaming, and formal presentations that include a comprehensive assessment of the student project. Credits: 3.0 Lec-Rec-Lab: (0-0-6) Semesters Offered: Spring Prerequisites: MET 4570

MET 4700 Applied Mechanical Vibrations Introduction to mechanical vibration with emphasis on machinery diagnostics. Covers single- and multiple-degree-of-freedom systems as well as applications of FE, MATLAB and SDRC Master Series used in examining practical case studies. Students introduced to FFT analyzers and accelerometers. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Fall Prerequisites: MET 2130 and MAT 3225 or permission of instructor

Mining Engineering (MG)

MG 2010 Safety in Engineering Practice Learn how safe practices lead to higher production. Covers principles and legal standards of health and safety (OSHA and MSHA), hazard recognition, and preventive and corrective actions. Credits: 1.0 Lec-Rec-Lab: (0-0-3) Semesters Offered: Spring
MG 4410 Non-Explosive Rock Fragmentation  Examines mechanical methods of fragmenting rock. Credit: 3.0 Lec-Rec-Lab: (0-2-2) Semesters Offered: Fall Spring

MG 4500 Rock Mechanics  Discover and predict the behavior of rock systems, beginning with continuum mechanics and constitutive relations, including Mohr's circle. Credit: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Fall Spring

MG 4510 Rock Mechanics Laboratory  Become familiar with the standard methods of measuring engineering properties of rock, and incorporating those properties in analyses of underground and surface excavations. Credit: 1.0 Lec-Rec-Lab: (0-0-3) Semesters Offered: Fall Prerequisites: (MEEM 2120 or MEEM 2150) and (MG 2400 or GE 3000) or permission of instructor

MG 4520 Engineering Rock Mechanics  Nature of rock mechanics problems. Includes analysis of stress-strain and elasticity; rock failure theories and strength; surface and underground mine stability, covering pit slopes and tailings dams; roof and pillar systems; functions of supports; roof control; rock mass characterization and engineering classifications. Credit: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Fall Prerequisites: MEEM 2120 or permission of instructor

MG 4530 Stability of Excavations  Evaluation of the stability of surface and underground excavations in rock and soil. Topics include preventive excavation design and design of mitigation measures for unstable situations. Credit: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Spring Prerequisites: MG 4500 or permission of instructor

MG 4600 Geostatistics  In-depth review of classical statistics and an introduction to principles of geostatistics, the theory of spatially correlated random variables and its application on the evaluation of mineral resources, strategic exploration planning, ore reserve estimation, and production planning. Examines various real case studies from the mining and petroleum industries. Credit: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Fall Prerequisites: MA 3710 or permission of instructor

MG 4610/EC 4610 Mineral Industry Economics  Studies the role of minerals and metals in society and the economics of their use. Applies economic principles to examine the supply, demand, markets, and foreign trade for important minerals and metals. Examines the effect of government policies on the mining industries. Requires a technical report. Credit: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Fall Spring Prerequisites: EC 2000 and UN 2002 or permission of instructor

MG 4700 Ore Reserve Analysis and Evaluation  Comparison of mining with other industrial enterprises, classifications of reserves, sampling methods and the irretrievability, conventional and geostatistical methods of ore reserve analysis, and current grade theory and its application. Credit: 2.0 Lec-Rec-Lab: (0-2-0) Semesters Offered: Spring Prerequisites: MG 3030 or permission of instructor

MG 4800 Ventilation and Air Conditioning  Properties and behavior of air and mine gases, and dust control in mines. Credit: 3.0 Lec-Rec-Lab: (0-1-2) Semesters Offered: Fall Spring Prerequisites: PH 2200 or permission of instructor

MG 4900 Mine Design I Capstone Design Course  Design a mine beginning from typical exploration data. Research, make decisions, and present conclusions in teams. Credit: 3.0 Lec-Rec-Lab: (0-2-3) Semesters Offered: Fall Spring Prerequisites: MG 3030 and MG 3300 and MG 4700 or permission of instructor

MG 4910 Mine Design II Capstone Design Project  Continuation of MG4900. Credit: 3.0 Lec-Rec-Lab: (0-2-3) Semesters Offered: Spring Prerequisites: MG 4900 or (MG 3030 and MG 3300 and MG 4700) or permission of instructor

MG 4980 Special Topics in Mining Engineering  Mining engineering topics not included in regular undergraduate courses. Credit: variable to 3.0; repeatable to a max of 6 Lec-Rec-Lab: (0-0-0) Semesters Offered: On Demand Restrictions: Permission of instructor required; must be enrolled in one of the following Classes: Junior Senior

MG 4990 Undergraduate Research in Mining Engineering  Research in mining engineering, approved and supervised by departmental faculty. Credit: variable to 3.0; repeatable to a max of 6 Lec-Rec-Lab: (0-0-0) Semesters Offered: Spring Summer Restrictions: Permission of instructor required

Materials Science and Engineering (MY)

MY 2100 Introduction to Materials Science and Engineering  Introduction to the structure, processing, properties, and performance of engineering materials, including metals, polymers, glasses, ceramics, and composites. Presents case studies covering selection of materials, component design, and analysis of component failures. Credit: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Fall Spring

MY 2170 Introduction to Minerals and Materials Processing  Fundamentals of minerals processing, raw materials production, and extractive metallurgy, including primary metals production. Credit: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Fall Spring

MY 3100 Materials Processing I  Classical chemical thermodynamics as applied to single and multicomponent materials systems. Topics include heat and mass balance, enthalpy, entropy, free energy, chemical reactions and equilibria, mass action, solution thermodynamics, phase diagram, stability/Pourbaix diagrams and electrochemistry. Credit: 4.0 Lec-Rec-Lab: (4-0-0) Semesters Offered: Fall Prerequisites: MY 2100

MY 3110 Materials Processing II  Continuation of Materials Processing I, which introduces the fundamental theories and equations governing transport phenomena. Topics include fluid flow, heat flow, diffusion, and chemical kinetics. Discusses the relationships between these subjects and the thermodynamic concepts covered in Materials Processing I. Credit: 4.0 Lec-Rec-Lab: (4-0-0) Semesters Offered: Spring Prerequisites: MY 3100 and MY 2200
MY 3200 Materials Characterization I Fundamentals of microstructural and chemical characterization of materials. Examines the physical principles controlling the various basic characterization techniques. Topics include crystallography, optics, optical and electron microscopy, diffraction and spectroscopy. Laboratory focuses on proper operational principles of characterization equipment, which includes optical and other microscopy methods and various diffraction techniques. Credits: 4.0 Lec-Rec-Lab: (2-1-3) Semesters Offered: Fall Prerequisites: MY 2100

MY 3210 Materials Characterization II Fundamentals of structural characterization. A continuation of Materials Characterization I which examines additional structural techniques such as thermal analysis, calorimetry, and particle size analysis, scanning tunneling and atomic force microscopy. Discusses the limitations/possibilities of basic characterization techniques as well as data analysis methods and practices. Credits: 4.0 Lec-Rec-Lab: (2-1-3) Semesters Offered: Spring Prerequisites: MY 3200

MY 3220 Ore Characterization Methods Methods of identifying ores and minerals, including visual examination, optical microscopy, x-ray diffraction, x-ray spectroscopy, and electron microscopy. Credits: 3.0 Lec-Rec-Lab: (2-0-3) Semesters Offered: Spring Prerequisites: MY 3100 and MY 3200

MY 3300 Design of Microstructure Relates thermodynamic and kinetic principles to phase transformations and microstructural evolution. Topics include nucleation, solidification, precipitation, recrystallization, grain growth, and sintering. Applications of these concepts include, e.g., heat treatment of steel, casting, powder processing, etc.) are presented and reinforced by laboratory exercises in the corequisite course Materials Characterization II. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Spring Prerequisites: MY 3100 and MY 3200

MY 3400 Mechanical Properties of Materials Introduction to the deformation and fracture behavior of metals, ceramics, polymers, and composites. Topics include yielding criterion, plastic deformation, strain hardening, strengthening mechanisms, viscoelasticity, fatigue, fracture, and microstructure/mechanical property relationships. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Spring Prerequisites: MY 2100 and (MEEM 2120 or MEEM 2150)

MY 3600/GE 3600 Sampling and Data Analysis Fundamentals of physical sampling of large lots of materials, design of experiments, and statistical analysis. Credits: 3.0 Lec-Rec-Lab: (2-0-3) Semesters Offered: Spring

MY 4100 Primary Metals Processing Pyrometallurgical and electrometallurgical methods of extracting nonferrous metals from their mineral sources. Covers roasting, decomposition, and reduction reactions, slag-metals reactions, and electrolysis using aqueous and fused-salt electrolytes; principles of thermochemistry and kinetics to the reactions in ironmaking and steelmaking processes; environmental regulations and their impact on the industry. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Fall Prerequisites: MY 3100 and MY 3110

MY 4130 Principles of Metal Casting Principles of metal casting, including melting practice, casting design, mold design, heat transfer and solidification, fluid flow and gating design. Introduction to computer simulation techniques for mold filling, solidification, and development of residual stress. Structure-property relations in cast metals. Recycling and environmental issues of the cast metals industry. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Fall Prerequisites: MY 3100 and MY 3110

MY 4140 Ceramics Powder Materials The structure, defect chemistry, and properties of crystalline and amorphous ceramics. Processing of metallic and ceramic powders to useful components. Design with ceramics and powder-processed metals. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Fall Prerequisites: MY 2100

MY 4150 Composite Materials Structure, processing and properties of composite materials based on combinations of metals, ceramics, and polymers. Offered first half of spring semester. Credits: 2.0 Lec-Rec-Lab: (3-0-3) Semesters Offered: Spring Prerequisites: MY 2100

MY 4160 Corrosion and Environmental Effects Mechanisms of corrosion processes, electrochemical and oxidation kinetics, and fundamentals of corrosion engineering. Offered second half of spring semester. Credits: 2.0 Lec-Rec-Lab: (4-0-0) Semesters Offered: Spring

MY 4170 Materials and Energy in Society Includes history of material flow in an industrial society; waste and pollution; energy requirements; sustainable economy; life cycle of materials, including steel, aluminum, cement, polymers, semiconductors; product life cycle; recycling and reuse; design for the environment. Offered first half of spring semester. Credits: 2.0 Lec-Rec-Lab: (4-0-0) Semesters Offered: On Demand

MY 4200/MY 5200 Scanning Electron Microscopy Scanning electron microscopy, including theory of operation. Application to the analysis of metallographic, ceramic, geological, and biological materials, including chemical analysis using energy and wavelength dispersive spectroscopy, x-ray mapping, low voltage and high resolution imaging. Offered first half of fall semester. Credits: 2.0 Lec-Rec-Lab: (2-0-6) Semesters Offered: Fall Prerequisites: PH 2400

MY 4210/MY 5210 Diffraction Materials characterization using x-ray, electron and neutron diffraction. Concepts of the reciprocal lattice. Offered second half of fall semester. Credits: 2.0 Lec-Rec-Lab: (2-0-6) Semesters Offered: Fall Prerequisites: PH 2400

MY 4250/MY 5250 Practical Transmission Electron Microscopy Microscopy Practical aspects of materials characterization by transmission electron microscopy. Offered first half of spring semester. Credits: 2.0 Lec-Rec-Lab: (2-0-6) Semesters Offered: Spring Prerequisites: PH 2400


MY 4500 Particle Technology Fundamentals of particle processing, characterization, and separation. Topics include particle synthesis of raw materials and feedstocks; minerals; processing of materials such as fly ash; automobile recycling; newsprint; contaminated soils; recyclable materials such as batteries and tires; and sludge. Also covers zeta potential, particulate surface chemistry, and flocculation, and dispersion. Credits: 4.0 Lec-Rec-Lab: (3-0-3) Semesters Offered: Spring

MY 4510 Hydrometallurgy Introduction to the concepts of hydrometallurgical and electrochemical processing of ores. Reviews the chemical, thermodynamic, and kinetic principles that are essential for the field and employs plant-scale examples in illustrating the concepts. Also covers environmental concerns and processing. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Spring Prerequisites: MY 3100

MY 4520 Mineral Process Engineering Interfacial properties of solid particles in water and their effects on wet separation processes. Special emphasis on the flotation separation of minerals (oxides, silicates, sulfides, semisoluble and soluble salts) and waste materials. Credits: 4.0 Lec-Rec-Lab: (3-0-3) Semesters Offered: Fall

MY 4530 Surfaces and Interfaces Introduction to applied interfacial/surface chemistry. Discussion of the effects of interfacial phenomena on the separation processes used in material processing, waste recycling, and environmental engineering. Fabrication of new materials with surface properties designed based on the surface chemistry principles. Credits: 3.0 Lec-Rec-Lab: (2-0-3) Semesters Offered: Fall

MY 4700 Electronic Properties of Materials Uses principles of modern physics to rationalize the physical and electronic properties of various classes of materials, emphasizing solids. Topics include the band theory of solids; metallic materials; semiconductor physics, including the basis of elementary semiconductor devices; dielectric and optical properties of materials; magnetic materials; and superconductivity. Credits: 2.0 Lec-Rec-Lab: (2-0-3) Semesters Offered: Fall

MY 4710 Materials Science of Electronic Devices The use of materials science and engineering principles in the design and processing of electronic materials and devices. Topics include operating principles of solid-state electronic devices, electronic materials structure-processing-properties relationships, and materials issues in electronic device fabrication and performance. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Spring

MY 4800 and Material Process Selection in Design The principles of materials selection for engineering design. Topics include selection based on strength, stiffness, thermal properties, high temperature behavior, corrosion resistance, formability, joinability, manufacturability, recyclability, etc. Considers ethics and economics. Presents numerous case studies and examples. Credits: 3.0 Lec-Rec-Lab: (3-0-3) Semesters Offered: Spring Prerequisites: MY 2100

MY 4900 Materials Science and Engineering Capstone Design Project I Capstone senior design project, conducted in teams of students working on a problem with an industrial partner. Open to all engineering majors interested in interdisciplinary projects. Credits: 3.0 Lec-Rec-Lab: (0-0-0) Semesters Offered: Fall Restrictions: Must be enrolled in one of the following Classes/s: Senior

MY 4910 Materials Science and Engineering Capstone Design Project II Capstone senior design project, conducted in teams of students working on a problem with an industrial partner. Open to all engineering majors interested in interdisciplinary projects. Credits: 3.0 Lec-Rec-Lab: (0-1-6) Semesters Offered: Summer Restrictions: Must be enrolled in one of the following Classes/s: Senior Prerequisites: MY 4900

MY 4950 Mineral Process Engineering Process Design I Fundamentals of designing process operations. Students will be responsible for characterizing the ore and designing and conducting lab-scale experiments to determine the best process-handling schemes. The ultimate goal is to have the students use the information gathered in the laboratory to design and operate a pilot-scale operation. Credits: 3.0 Lec-Rec-Lab: (2-0-3) Semesters Offered: Fall Restrictions: Must be enrolled in one of the following Classes/s: Senior

MY 4960 Mineral Process Engineering Process Design II Fundamentals of designing process operations. Students are responsible for characterizing the ore and designing and conducting lab-scale experiments to determine the best process-handling schemes. The ultimate goal is to have the students use the information gathered in the laboratory to design and operate a pilot-scale operation. Credits: 3.0 Lec-Rec-Lab: (2-0-3) Semesters Offered: Spring

MY 4970 Special Topics Materials Special topics in materials science and engineering. Credits: variable to 4.0 May be repeated Lec-Rec-Lab: (0-0-0) Semesters Offered: On Demand Restrictions: Permission of instructor required

MY 4980 Special Topics Materials Special topics in materials science and engineering. Credits: variable to 4.0 May be repeated Lec-Rec-Lab: (0-0-0) Semesters Offered: On Demand

MY 4990 Undergraduate Research Undergraduate research in materials science and engineering. Independent research conducted under the guidance of a faculty member. Credits: variable to 6.0 May be repeated Lec-Rec-Lab: (0-0-0) Semesters Offered: On Demand Restrictions: Permission of instructor required
Physical Education (PE)

PE 0100 Personal Wellness Classroom work involves the five dimensions of wellness. Activity work supports the different dimensions. Offered the first half and the second half of fall and spring semesters. Credits: 0.5; graded Pass/Fail only Lec-Rec-Lab: (0-0-2) Semesters Offered: Fall Spring

PE 0101 Flag Football Fundamental skills, rules, and play of flag football. Offered the first half of fall semester. Credits: 0.5; graded Pass/Fail only Lec-Rec-Lab: (0-0-2) Semesters Offered: Fall

PE 0103 Bait and Fly Casting Bait and fly casting skills. Each student must have a suitable pole, reel, lines, and line as well as a valid current Michigan fishing license. Requires three Sunday classes. Offered the first half of fall semester and both tracks of summer session. Credits: 0.5; graded Pass/Fail only Lec-Rec-Lab: (0-0-2) Semesters Offered: Fall Summer

PE 0104 Ultimate Frisbee Fundamental skills, rules, and play of ultimate frisbee. The class includes physically strenuous Personal frisbee is recommended. Offered the first half of fall semester and the second half of spring semester. Credits: 0.5; graded Pass/Fail only Lec-Rec-Lab: (0-0-2) Semesters Offered: Fall Spring

PE 0105 Beginning Bowling Fundamental skills, rules, and scoring of bowling. Offered the first half of fall and spring semesters. Credits: 0.5; graded Pass/Fail only Lec-Rec-Lab: (0-0-2) Semesters Offered: Fall Spring

PE 0106 Beginning Golf Rules, terminology, and etiquette of golf and the individual skills of grip, stance, and swing. Equipment is supplied. Requires purchase of a golf pass. Offered the first half of fall semester and the first track of summer session. Credits: 0.5; graded Pass/Fail only Lec-Rec-Lab: (0-0-2) Semesters Offered: Fall Summer

PE 0107 Floor Hockey Individual skills, team techniques, rules and strategies of floor hockey. Hockey gloves or winter gloves are highly recommended. Sticks and goalie equipment are provided. Offered the last half of fall semester and the first half of spring semester. Credits: 0.5; graded Pass/Fail only Lec-Rec-Lab: (0-0-2) Semesters Offered: Fall Spring

PE 0111 Beginning Swimming Nonswimmers learn to have no fear of water, to float, and to swim the four fundamental strokes. Offered the last half of fall semester, the first half of spring semester, and the first track of summer session. Credits: 0.5; graded Pass/Fail only Lec-Rec-Lab: (0-0-2) Semesters Offered: Fall Spring Summer

PE 0112 Intermediate Swimming Students learn to swim four basic strokes with proficiency. Requires ability to swim the length of pool comfortably. Offered the last half of fall semester, the first half of spring semester, and the second track of summer session. Credits: 0.5; graded Pass/Fail only Lec-Rec-Lab: (0-0-2) Semesters Offered: Fall Spring Summer

PE 0116 Beginning Basketball Theory, organization, and defensive and offensive skills of basketball. Offered the first half and the last half of fall and spring semesters. Credits: 0.5; graded Pass/Fail only Lec-Rec-Lab: (0-0-2) Semesters Offered: Fall Spring

PE 0117 Beginning Hockey Individual skills, team techniques, rules, and strategies. Requires basic equipment to be on the ice in addition to helmet with face mask. Offered the first half of fall semester and the first half of spring semester. Credits: 0.5; graded Pass/Fail only Lec-Rec-Lab: (0-0-2) Semesters Offered: Fall Spring

PE 0118 Beginning Weight Training Training methods for physical development using stationary and free weights. Offered the first half and the last half of fall and spring semesters, and the first track of the summer session. Credits: 0.5; graded Pass/Fail only Lec-Rec-Lab: (0-0-2) Semesters Offered: Fall Spring Summer

PE 0120 Beginning Alpine Skiing (Downhill) Beginning skills in alpine skiing techniques. Requires own equipment; some rentals available. Requires purchase of a season pass for Montgomery. Offered the first half of spring semester. Credits: 0.5; graded Pass/Fail only Lec-Rec-Lab: (0-0-2) Semesters Offered: Fall Spring Summer

PE 0121 Beginning Snowboarding Fundamentals of snowboarding techniques. Own equipment recommended; some rental equipment is available, but not boots. Requires purchase of a season pass for Montgomery. Offered the first half of spring semester. Credits: 0.5; graded Pass/Fail only Lec-Rec-Lab: (0-0-2) Semesters Offered: Spring

PE 0122 Softball Fundamentals of throwing, fielding, and hitting a softball. Bats, balls, and bases are provided. Each student should bring a glove. Offered the first half of fall semester, the last half of spring semester, and the first and second tracks of summer session. Credits: 0.5; graded Pass/Fail only Lec-Rec-Lab: (0-0-2) Semesters Offered: Spring

PE 0126 Beginning Volleyball Fundamental skills, rules interpretation, strategy, and conduct of tournament play. Offered the first half of fall semester, and the first half and the last half of spring semester. Credits: 0.5; graded Pass/Fail only Lec-Rec-Lab: (0-0-2) Semesters Offered: Fall Spring

PE 0127 Beginning Archery Fundamentals of archery, such as selection of bows and other aspects of the sport. Offered the first half and the last half of fall and spring semesters. Credits: 0.5; graded Pass/Fail only Lec-Rec-Lab: (0-0-2) Semesters Offered: Fall Spring

PE 0130 Water Aerobics Improvement of fitness and body measurement through diet and water exercise. Offered the first half of fall semester and the last half of spring semester. Credits: 0.5; graded Pass/Fail only Lec-Rec-Lab: (0-0-2) Semesters Offered: Fall Spring

PE 0132 Beginning Soccer Fundamental skills, techniques, terminology, and rules of soccer. Offered the first half of fall semester. Credits: 0.5; graded Pass/Fail only Lec-Rec-Lab: (0-0-2) Semesters Offered: Fall

PE 0134 Beginning Gymnastics Covers gymnastics skills from beginning to intermediate level maneuvers on the following equipment: floor exercise, parallel bars, uneven parallel bars, high bar, balance beam, vault, pommel horse. Offered first half of semester, and first half and last half of spring semester. Credits: 0.5; graded Pass/Fail only Lec-Rec-Lab: (0-0-2) Semesters Offered: Fall Spring

PE 0135 Beginning Cross Country Skiing Develops the skills for touring/recreational cross country skiing. Own equipment is recommended; rental equipment available. Offered the first half of spring semester. Credits: 0.5; graded Pass/Fail only Lec-Rec-Lab: (0-0-2) Semesters Offered: Spring

PE 0138 Beginning Racquetball/Squash Fundamentals, rules, and basic strategies of racquetball/squash. Gives students opportunity to play singles, cutthroat, and doubles. Racquets, balls, and eye wear provided. Recommended use of personal racquet. Offered the first half of fall and spring semesters. Credits: 0.5; graded Pass/Fail only Lec-Rec-Lab: (0-0-2) Semesters Offered: Fall Spring

PE 0141 Softball Officiating Stresses theory and technique of softball officiating, knowledge, and interpretation of rules. Students gain actual officiating experience and may become registered officials. Requires own eyes protection. Offered the first half of fall semester and the last half of spring semester. Credits: 0.5; graded Pass/Fail only Lec-Rec-Lab: (0-0-2) Semesters Offered: Fall Spring Summer

PE 0143 Basketball Officiating Theory and technique of basketball officiating. Stresses knowledge and interpretation of rules. Students gain actual officiating experience and may become registered officials. Offered the first half of spring semester. Credits: 0.5; graded Pass/Fail only Lec-Rec-Lab: (0-0-2) Semesters Offered: Spring

PE 0144 Volleyball Officiating Theory and technique of volleyball officiating. Stresses knowledge and interpretation of rules. Students gain actual officiating experience and may become registered officials. Offered the last half of spring semester. Credits: 0.5; graded Pass/Fail only Lec-Rec-Lab: (0-0-2) Semesters Offered: Spring

PE 0145 Beginning Rifle Using precision air rifles, beginners develop an awareness of firearms safety and marksmanship. Offered the first half and the second half of fall and spring semesters. Credits: 0.5; graded Pass/Fail only Lec-Rec-Lab: (0-0-2) Semesters Offered: Fall Spring

PE 0146 Beginning Billiards Introduction to the etiquette, rules, and recreational value of pocket billiards. Offered the first half and the last half of fall semester, and the first half of spring semester. Credits: 0.5; graded Pass/Fail only Lec-Rec-Lab: (0-0-2) Semesters Offered: Fall Spring

PE 0148 Beginning Skating Fundamental skills of ice skating, including proper stroking forward and backward, edges, crossovers, stops, and other basic skills. Requires own skates. Offered the first half and the last half of fall semester and the first half of spring semester. Credits: 0.5; graded Pass/Fail only Lec-Rec-Lab: (0-0-2) Semesters Offered: Fall Spring

PE 0152 Beginning Social Dance Introduction to a variety of dance steps, such as the jitterbug/swing, polka, country 2 step, tango, waltz, fox trot, and slow dance. Offered the first half and the last half of fall and spring semesters, and the first and second tracks of summer session. Credits: 0.5; graded Pass/Fail only Lec-Rec-Lab: (0-0-2) Semesters Offered: Spring

PE 0153 Beginning Aerobics Improvement of cardiovascular fitness, strength, coordination, and body mechanics through exercise. Offered the first half and the last half of fall and spring semesters. Credits: 0.5; graded Pass/Fail only Lec-Rec-Lab: (0-0-2) Semesters Offered: Fall Spring

PE 0156 Beginning Mountain Biking Learn to be comfortable and confident while riding a mountain bike off-road. Covers basic mountain biking procedures. Requires own equipment and supplies as well as a biking helmet. Offered the first half of fall semester and the first track of summer session. Credits: 0.5; graded Pass/Fail only Lec-Rec-Lab: (0-0-2) Semesters Offered: Fall Spring

PE 0166 Moving for Fitness Running, walking, rollerblading, and biking. Basic movement at your own level. Requires own equipment for all activities. Offered the first half of fall semester, and the first and second tracks of summer session. Credits: 0.5; graded Pass/Fail only Lec-Rec-Lab: (0-0-2) Semesters Offered: Fall Summer

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PE 0170 Beginning Taekwondo and Hapkido Introduction to the basic kicking, blocking, punching, joint locking, and throwing techniques of Taekwondo and Hapkido. Emphasizes improvement of flexibility. Offered the first half of fall and spring semesters. Credits: 0.5; graded Pass/Fail only Lec-Rec-Lab: (0-0-2) Semesters Offered: Fall Spring

PE 0173 Fall Outdoor Adventures Outdoor seasonal activities to include hiking, camping, fishing, orienteering, etc. Offered the first half of fall semester. Credits: 0.5; graded Pass/Fail only Lec-Rec-Lab: (0-0-2) Semesters Offered: Fall

PE 0174 Winter Outdoor Adventures Outdoor seasonal activities to include fishing, camping, skiing, orienteering, etc. Offered the first half of winter semester. Credits: 0.5; graded Pass/Fail only Lec-Rec-Lab: (0-0-2) Semesters Offered: Spring

PE 0205 Intermediate/Advanced Bowling Intermediate to advanced techniques in bowling, including skills and strategy involved in tournament play. Offered the last seven and one-half weeks of the fall and spring semesters. Credits: 0.5; graded Pass/Fail only Lec-Rec-Lab: (0-0-2) Semesters Offered: Fall Spring

PE 0206 Intermediate/Advanced Golf Intermediate to advanced individual instruction in golf techniques, terms, courtesies, and tournament regulations. Equipment needed; some rental clubs available. Requires purchase of golf pass. Offered the first half of fall semester and the second track of summer semester. Credits: 0.5; graded Pass/Fail only Lec-Rec-Lab: (0-0-2) Semesters Offered: Fall Summer

PE 0210 Special Topics in Physical Education Unconventional activity courses that address varying and/or emergent needs. Topics vary. Offered the first half and the last half of fall and spring semesters, and the first and second tracks of summer session. Credits: 0.5; repeatable to a max of 2; graded Pass/Fail only Lec-Rec-Lab: (0-0-2) Semesters Offered: Fall Spring Summer

PE 0211 Advanced Swimming Polishes the basic strokes and introduces additional techniques, competitive skills, and knowledge in creating workouts to encourage swimming as a lifetime fitness activity. Requires proficiency in swimming basic strokes. Offered the first half of fall semester. Credits: 0.5; graded Pass/Fail only Lec-Rec-Lab: (0-0-2) Semesters Offered: Fall

PE 0216 Intermediate/Advanced Basketball Intermediate to advanced techniques, skills, and strategies of basketball. Offered the last half of fall and spring semesters. Credits: 0.5; graded Pass/Fail only Lec-Rec-Lab: (0-0-2) Semesters Offered: Fall Spring

PE 0217 Intermediate/Advanced Hockey Intermediate/advanced techniques, skills, and strategies in hockey. Requires basic equipment to be allowed on the ice as well as helmet with face mask. Offered last half of fall semester and first half of spring semester. Credits: 0.5; graded Pass/Fail only Lec-Rec-Lab: (0-0-2) Semesters Offered: Fall Spring

PE 0218 Intermediate/Advanced Weight Training Intermediate to advanced techniques of weight lifting. Offered the last half of fall and spring semesters, and the second track of summer session. Credits: 0.5 Graded

PE 0220 Intermediate/Advanced Alpine Skiing (Downhill) Intermediate to advanced skills in alpine skiing technique. Own equipment recommended; rental equipment available. Basic skills evaluate on the last half of fall semester; intermediate and advanced on the last half of spring semester. Equipment provided. Recommend use of personal racquet. Offered first half and last half of fall semester. Credits: 0.5; graded Pass/Fail only Lec-Rec-Lab: (0-0-2) Semesters Offered: Spring

PE 0221 Intermediate/Advanced Snowboarding Intermediate to advanced techniques, skills, and strategies of snowboarding. Basic skills evaluated to ensure level of proficiency. Own equipment recommended; some rental equipment available, except boots. Requires purchase of a season pass for Mont Ripley. Offered the first half of spring semester. Credits: 0.5; graded Pass/Fail only Lec-Rec-Lab: (0-0-2) Semesters Offered: Spring

PE 0226 Intermediate/Advanced Volleyball Organization and development of team competition in volleyball. Requires previous volleyball experience. Offered the first half of fall semester, and the first half and the last half of spring semester. Credits: 0.5; graded Pass/Fail only Lec-Rec-Lab: (0-0-2) Semesters Offered: Fall Spring

PE 0227 Intermediate/Advanced Archery Intermediate to advanced techniques and skills involved in archery. Requires own bow. Offered the first half and the last half of fall and spring semesters. Credits: 0.5; graded Pass/Fail only Lec-Rec-Lab: (0-0-2) Semesters Offered: Fall Spring

PE 0230 Water Polo Fundamental skills, rules, strategy, and play of waterpolo. Offered the first half of spring semester. Credits: 0.5; graded Pass/Fail only Lec-Rec-Lab: (0-0-2) Semesters Offered: Spring

PE 0232 Intermediate/Advanced Soccer Intermediate to advanced techniques, skills, and strategies involved in soccer. Offered the first half of fall semester. Credits: 0.5; graded Pass/Fail only Lec-Rec-Lab: (0-0-2) Semesters Offered: Fall

PE 0234 Intermediate Gymnastics Advanced beginning to intermediate level gymnastics skills in the following: floor exercise, parallel bars, uneven parallel bars, high bar, balance beam, vault, and trampoline. Requires prior gymnastics experience. Offered the last half of fall semester. Credits: 0.5; graded Pass/Fail only Lec-Rec-Lab: (0-0-2) Semesters Offered: Fall

PE 0235 Intermediate/Advanced Cross Country Skiing Development of touring, recreational, and racing skills in cross country skiing. Own equipment is recommended; rental equipment available. Basic skills evaluated to ensure proper level of skiing proficiency. Offered the first half of spring semester. Credits: 0.5; graded Pass/Fail only Lec-Rec-Lab: (0-0-2) Semesters Offered: Spring

PE 0238 Intermediate/Advanced Racquetball/Squash Reviews the fundamentals and instructs the students on the intermediate/advanced skills of racquetball and squash. Gives all students the opportunity to play singles, cutthroat, and doubles. Racquets, balls, and eyewear provided. Recommend use of personal racquet. Offered the first half of fall and spring semesters. Credits: 0.5; graded Pass/Fail only Lec-Rec-Lab: (0-0-2) Semesters Offered: Fall Spring

PE 0239 Intermediate/Advanced Badminton Intermediate to advanced techniques, skills, and strategies involved in badminton. Offered the last half of fall semester. Credits: 0.5; graded Pass/Fail only Lec-Rec-Lab: (0-0-2) Semesters Offered: Fall Spring

PE 0240 Intermediate/Advanced Tennis Intermediate to advanced techniques, skills, and strategies in tennis. Class meets at Gates Tennis Center. Tennis balls and racquets provided. Recommend use of personal racquet. Offered first half and last half of fall and spring semesters, and second track of summer session. Credits: 0.5; graded Pass/Fail only Lec-Rec-Lab: (0-0-2) Semesters Offered: Fall Summer

PE 0246 Intermediate/Advanced Billiards Intermediate to advanced techniques, skills, and strategies in billiards. Offered the first half of fall and spring semesters. Credits: 0.5; graded Pass/Fail only Lec-Rec-Lab: (0-0-2) Semesters Offered: Fall Spring

PE 0248 Intermediate/Advanced Swimming Reviews the fundamentals and introduces additional techniques, competitive skills, and knowledge in creating workouts to encourage swimming as a lifetime fitness activity. Requires proficiency in swimming basic strokes. Offered the first half of fall semester and the first half of spring semester. Credits: 0.5; graded Pass/Fail only Lec-Rec-Lab: (0-0-2) Semesters Offered: Fall Summer

PE 0252 Intermediate Social Dance Continuation of beginning social dance. Offered the last half of spring semester. Credits: 0.5; graded Pass/Fail only Lec-Rec-Lab: (0-0-2) Semesters Offered: Spring

PE 0253 Intermediate/Advanced Aerobics Intermediate to advanced techniques and steps involved in aerobics. Requires previous aerobic experience. Offered the last half of fall semester and the first half and the last half of spring semester. Credits: 0.5; graded Pass/Fail only Lec-Rec-Lab: (0-0-2) Semesters Offered: Fall Spring

PE 0256 Intermediate/Advanced Mountain Biking Intermediate to advanced techniques and skills involved in mountain biking. Offered the first half of fall semester and the second track of summer session. Credits: 0.5; graded Pass/Fail only Lec-Rec-Lab: (0-0-2) Semesters Offered: Fall Summer

PE 0266 Running for Fitness The techniques, skills, and strategies involved in running. The class is physically strenuous. Requires appropriate running shoes and attire. Offered the first half of fall semester and the last half of spring semester. Credits: 0.5; graded Pass/Fail only Lec-Rec-Lab: (0-0-2) Semesters Offered: Fall Spring

PE 0270 Intermediate/Advanced Tae Kwon Do and Hapkido Intermediate to advanced techniques, skills, and strategies involved in Tae Kwon Do. Offered the last half of fall and spring semesters. Credits: 0.5; graded Pass/Fail only Lec-Rec-Lab: (0-0-2) Semesters Offered: Fall Spring

PE 0415 Individual Athletics for Seniors Independent study to help graduating seniors earn their PE class activity requirements through aerobic workouts. Offered the first half and the last half of fall and spring semesters. Credits: 0.5; graded Pass/Fail only Lec-Rec-Lab: (0-0-2) Semesters Offered: Fall Spring Restrictions: Permission of department required; must be enrolled in one of the following Class(es): Senior

PE 0410 Varsity Football Selective collegiate-level sports participation requiring an elite level of skill and extensive time commitment. Credits: 1.0; may be repeated; graded Pass/Fail only Lec-Rec-Lab: (0-0-5) Semesters Offered: Fall Spring

PE 0420 Varsity Basketball Selective collegiate-level sports participation requiring an elite level of skill and extensive time commitment. Credits: 1.0; may be repeated; graded Pass/Fail only Lec-Rec-Lab: (0-0-5) Semesters Offered: Fall Spring

PE 0430 Varsity Hockey Selective collegiate-level sports participation requiring an elite level of skill and extensive time commitment. Credits: 1.0; may be repeated; graded Pass/Fail only Lec-Rec-Lab: (0-0-5) Semesters Offered: Fall Spring

PE 0440 Varsity Nordic Skiing Selective collegiate-level sports participation requiring an elite level of skill and extensive time commitment. Credits: 1.0; may be repeated; graded Pass/Fail only Lec-Rec-Lab: (0-0-5) Semesters Offered: Fall Spring

PE 0480 Varsity Track Selective collegiate-level sports participation requiring an elite level of skill and extensive time commitment. Credits: 1.0; may be repeated; graded Pass/Fail only Lec-Rec-Lab: (0-0-5) Semesters Offered: Spring

PE 2140 Varsity Cross Country A collegiate-level sports participation requiring an elite level of skill and extensive time commitment. Credits: 1.0; may be repeated; graded Pass/Fail only Lec-Rec-Lab: (0-0-5) Semesters Offered: Spring

PE 2150 Cross Training A broad base understanding of sports cross training and activities that can be pursued as lifelong activities. Credits: 1.0; may be repeated; graded Pass/Fail only Lec-Rec-Lab: (0-0-5) Semesters Offered: Fall Spring
PE 2230 Cheerleading Dance Team  A dance squad that attends set class practices and participates in athletic contests. A varsity letter is earned by those who fulfill the requirements. Credits: 1.0; may be repeated; graded Pass/Fail only Lec-Rec-Lab: (0-0-5) Semesters Offered: Fall Spring

PE 2240 Cheerleading Stunt Team  A stunt squad that attends set class practices and participates in athletic contests. A varsity letter is earned by those who fulfill the requirements. Credits: 1.0; may be repeated; graded Pass/Fail only Lec-Rec-Lab: (0-0-5) Semesters Offered: Fall Spring

PE 2280 Ski Patrol (First Aid)  First of two-course sequence required for Alpine and Nordic Ski Patrol candidates. Ninety hours of instruction includes three weekends. Requires payment of dues to become member of National Ski Patrol. Certification in National Ski Patrol Outdoor Emergency Care is available upon completion. Taught with PE 2290. Credits: 1.0 Lec-Rec-Lab: (0-2-4) Semesters Offered: Fall Prerequisites: PE 2290

PE 2290 Ski Patrol (Hill)  National Ski Patrol training involving fitness, skiing proficiency, toboggan handling, and lift evacuation. Leads to qualifying membership test into National Ski Patrol. Required for National Ski Patrol candidates. Requires purchase of a season pass for Mont Ripley. Offered first half of spring semester. Credits: 1.0 Lec-Rec-Lab: (0-0-4) Semesters Offered: Spring

PE 2370 Lifeguard Training  Standard Red Cross lifeguarding methods and techniques, leading to certification in lifeguarding, first aid, and CPR. Requires strong 500-yard continuous swim using front crawl, breaststroke, and sidestroke. Credits: 2.0 Lec-Rec-Lab: (1-0-3) Semesters Offered: Fall

PE 2500 Sports Safety Training  Provides students knowledge and skills necessary to help provide safe environment to adult and child athletes and, in an emergency, to help sustain life and minimize consequences of injury or sudden illness until medical help arrives. Offered the first half of fall semester. Credits: 1.0 Lec-Rec-Lab: (1-0-1) Semesters Offered: Fall

PE 2570 Exercise and Lifetime Fitness  Emphasizes the five dimensions of wellness. The body's reaction to endurance conditioning, diet and weight control, strength training, and flexibility. Students assess their own fitness level. Emphasizes lifetime fitness and self-structured exercise. Credits: 1.0 Lec-Rec-Lab: (0-0-3) Semesters Offered: Fall Spring

PE 2580 Water Safety  Instructor Teaching techniques for all levels of swimming, leading to Red Cross certification in WSI. Requires excellent execution of all strokes (Red Cross Level IV). Credits: 2.0 Lec-Rec-Lab: (0-0-4) Semesters Offered: Spring

PE 3000 Master Student Athlete  Read, discuss, and practice study skills, cognitive strategies, goal development, and address contemporary issues problematic in today's college environment. Offered the first half and the last half of fall semester. Credits: 1.0 Lec-Rec-Lab: (0-0-3) Semesters Offered: Fall

PE 3980 CPR  Lecture, demonstration, and practice of adult, infant, and child CPR knowledge and skills. Requires purchase of a face plate through the Central Ticket Office. Offered the first half and the last half of fall and spring semesters. Credits: 1.0 Lec-Rec-Lab: (1-0-2) Semesters Offered: Fall Spring

PE 3990 Community First Aid  Lecture, demonstration, and practice of first aid knowledge and skills. Offered the first half and the last half of fall and spring semesters. Credits: 1.0 Lec-Rec-Lab: (1-0-2) Semesters Offered: Fall Spring

PE 4010 Psychology of Coaching  Emphasizes the application of psychological principles to the sports setting as they affect teaching styles, individual athletes, and athletic performance. Credits: 3.0 Lec-Rec-Lab: (1-1-1) Semesters Offered: Spring Prerequisites: UN1002 or UN1003

PE 4020 Foundations of Coaching  Practical and relevant information appropriate for beginning and experienced interscholastic coaches. Credits: 3.0 Lec-Rec-Lab: (0-4-0) Semesters Offered: Fall

PE 4030 Contemporary Issues in Sports  Help potential coaches understand the role of sports in society with emphasis on current controversial sports issues. Credits: 2.0 Lec-Rec-Lab: (2-0-0) Semesters Offered: Spring

PE 4040 Sport and Exercise Science  Basic human anatomy and physiology and its application to biomechanics. Understanding biomechanics as external and internal forces that act on the human body and the resultant forces produced. Credits: 2.0 Lec-Rec-Lab: (1-0-2) Semesters Offered: Spring

PE 4050 Introduction to Athletic Training  Designed for coaches. Covers first aid, adult CPR, child CPR, and other sport training issues. Students receive American Red Cross Sports Safety Training, adult CPR, and child CPR cards. Credits: 3.0 Lec-Rec-Lab: (2-0-1) Semesters Offered: Fall

PE 4060 Theory and Organization  Coaching theory and organization using strategies, game plans, drills, and organization of individual and teams parts from preseason through the competition season and off-season. Credits: 1.0 Lec-Rec-Lab: (1-0-2) Semesters Offered: Fall Spring

PE 4100 Coaching Practicum  Students seeking coaching endorsement assist with a sport of their choice. Subject to approval of endorsement advisor; students may assist a head coach in season during student teaching; assist MTU head coach in season; assist head coach in season at public/private school or summer camp. Credits: 2.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Fall Spring Restrictions: Permission of instructor required Prerequisites: PE 4010 and PE 4020

PH 0010 Development of Physics Skills  Individualized instruction in physics problem solving and general study skills from professional physics coaches. Benefits students looking for help with demanding introductory physics courses (PH1110, PH1210, PH2100, PH2200). Credits do not count toward graduation. Credits: 1.0; repeatable to a max of 3; graded Pass/Fail only Lec-Rec-Lab: (0-1-0) Semesters Offered: Fall Spring Restrictions: Permission of instructor required

PH 0020 Team Approach to Learning Physics  Students meet 3 hours/week with 4 to 6 team members taking the same introductory physics course. Students work with a professional physics coach to learn the team approach to physics problem solving. Benefits students looking for help with demanding courses who desire experience in team problem solving. Credits do not count toward graduation. Credits: 1.0; repeatable to a max of 3; graded Pass/Fail only Lec-Rec-Lab: (0-0-3) Semesters Offered: Fall Spring

PH 1100 Introductory Physics Lab I  Introduction to physics concepts of mechanics, waves, and thermodynamics through hands-on discovery-based learning. Emphasizes small-group collaboration, peer learning, observation, prediction, data acquisition, and data analysis. Credits: 1.0 Lec-Rec-Lab: (0-0-2) Semesters Offered: Fall Spring Summer

PH 1100H Introductory Physics Lab I Honors  See PH 1100. The honors course covers material in more depth for more-motivated students. Credits: 1.0 Lec-Rec-Lab: (0-0-2) Semesters Offered: Fall Spring Restrictions: Permission of instructor required; must be enrolled in one of the following Major(s): Applied Physics, Physics

PH 1110 College Physics I  An overview of basic principles of kinematics, dynamics, elasticity, fluids, heat, thermodynamics, mechanical waves, and interference and diffraction of mechanical waves. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Fall Spring Prerequisites: (PH 1100 or PH 1100H) and (MA 1033 or MA 1032 or MAT 1115) or permission of instructor

PH 1200 Introductory Physics Lab II  Introduction to physics concepts of electricity, magnetism, optics, and light through hands-on discovery-based learning. Emphasizes small-group collaboration, peer learning, observation, prediction, data acquisition, and data analysis. Credits: 1.0 Lec-Rec-Lab: (0-0-2) Semesters Offered: Fall Spring Summer Prerequisites: PH 1100 or PH 1100H or permission of instructor

PH 1200H Introductory Physics Lab II Honors  See PH 1200. The honors course covers topics in more depth for more-motivated students. Credits: 1.0 Lec-Rec-Lab: (0-0-2) Semesters Offered: Fall Spring Restrictions: Permission of instructor required; must be enrolled in one of the following Major(s): Applied Physics, Physics Prerequisites: PH 1100 or PH 1100H

PH 1210 College Physics II  An overview of basic principles of static and dynamic electricity and magnetism, electromagnetic waves, reflection and refraction of light, interference and diffraction of light, special theory of relativity, wave theory of matter, particle theory of electromagnetic waves, theory of the atom, the nucleus, and elementary particles. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Fall Spring Prerequisites: (PH 1200 or PH 1200H) and PH 1110 or permission of instructor

PH 1600 Introductory Astronomy  Introduces fundamentals of astronomy. Topics include Kepler's and Newton's laws of motion, origin and evolution of the solar system, galactic astronomy, extra-galactic astronomy, cosmology, and modern instrumentation, including space-based astronomy. Credits: 2.0 Lec-Rec-Lab: (2-0-0) Semesters Offered: Fall

PH 1610 Introductory Astronomy Lab  Demonstrates fundamentals of astronomy using non-telescopic and telescopic observations, and computer simulations. Topics include angular size measurements, season-dependent measurements, phases of the moon, phases and orbits of planets, brightness of stars, introduction to the use of MTU's Observatory, instrumentation, and applications of computer programs involving cosmology. Credits: 1.0 Lec-Rec-Lab: (0-0-2) Semesters Offered: Fall Spring Corequisites: PH 1600

PH 2100 University Physics I-Mechanics  A calculus-based introduction to classical mechanics. Topics include kinematics, Newton's laws, work and energy, the universal law of gravitation, systems of particles, rotational motion, oscillations, and transverse waves. Credits: 3.0 Lec-Rec-Lab: (2-2-0) Semesters Offered: Fall Spring Summer Prerequisites: (PH 1110 or PH 1100H) and (MA 1150 or MA 1160) and (MA 2150(C) or MA 2160(C))

PH 2100H University Physics I-Honors Mechanics  A calculus-based introduction to classical mechanics. Topics include kinematics, Newton's laws, work and energy, the universal law of gravitation, systems of particles, rotational motion, oscillations, and transverse waves. The honors course treats topics in a greater depth for more-motivated students. Credits: 3.0 Lec-Rec-Lab: (0-4-0) Semesters Offered: Spring Restrictions: Permission of instructor required; must be enrolled in one of the following Major(s): Applied Physics, Physics Prerequisites: (PH 1100 or PH 1100H) and MA 1150 and MA 2150(C)
PH 2200 University Physics II-Electricity and Magnetism A calculus-based introduction to magnetism. Topics include Coulomb's law, electric fields, Gauss's law, electric potential, capacitance, circuits, magnetic forces and fields, Ampere's law, induction, Maxwell's equations, electromagnetic waves and geometrical optics. Credits: 3.0 Lec-Rec-Lab: (2-0-2) Semesters Offered: Fall Spring Summer Prerequisites: PH 1200 or PH 1200H and (PH 2110 or PH 2110H) and (MA 2150 or MA 2160)

PH 2200H University Physics II-Honors Electricity and Magnetism A calculus-based introduction to electromagnetism. Topics include Coulomb's law, electric fields, Gauss's law, electric potential, capacitance, curvits, magnetic forces and fields, Ampere's law, induction, Maxwell's equations, electromagnetic waves and geometrical optics. The honors course treats topics in greater depth for more-motivated students. Credits: 3.0 Lec-Rec-Lab: (2-0-2) Semesters Offered: Fall Restrictions: Permission of instructor required; must be enrolled in one of the following Major(s): Applied Physics, Physics Prerequisites: (PH 2110 or PH 2110H) and (PH 1200 or PH 1200H) and (MA 2150 or MA 2160)

PH 2230 Electronics for Scientists Introduction to analog and digital electronics with an emphasis on their use in the laboratory. Topics include linear devices and basic linear circuit analysis; diodes, transistors; op-amps; the use of digital components, including logic gates, flip-flops, counters, clocks and microcontrollers, and analog to digital conversions. Credits: 4.0 Lec-Rec-Lab: (3-0-3) Semesters Offered: Spring Prerequisites: PH 2200 or PH 2200H or permission of instructor

PH 2300 University Physics III-Fluids and Thermodynamics A calculus-based introduction to fluids and thermal physics. Topics include fluid motion, propagation of heat and sound, and temperature and the kinetic theory of gases, heat capacity and latent heat, first law of thermodynamics, heat engines and the second law, entropy, and an introduction to statistical mechanics. Credits: 3.0 Lec-Rec-Lab: (2-0-2) Semesters Offered: Fall Spring Summer Prerequisites: PH 2100 or PH 2100H

PH 2400 University Physics IV-Waves and Modern Physics A calculus-based introduction to waves and modern physics. Topics include interference and diffraction, special relativity, photons and matter waves, the Bohr atom, wave mechanics, atomic physics, molecular and solid-state physics, and nuclear physics. Credits: 2.0 Lec-Rec-Lab: (3-0-3) Semesters Offered: Fall Spring Summer Prerequisites: PH 2200 or PH 2200H

PH 2640/GE 2640 Introduction to Meteorology Introduction to the fundamentals of meteorology and atmospheric science, including atmospheric composition and structure, atmospheric thermodynamics, radiative transfer, atmospheric fluid dynamics, and cloud physics. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Fall; offered alternate years beginning with the 2000-01 academic year

PH 3110 Theoretical Mechanics I An intermediate study of mechanics, including the study of relativistic mechanics, kinematics, Newtonian mechanics of a single particle, oscillations, motion in noninertial reference frames, and gravitation and central-force motion. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Fall; Prerequisites: PH 2400 and (MA 3520 or MA 3530)

PH 3111 Theoretical Mechanics II A continuation of PH 3110. Includes the study of the dynamics of a system of particles, rigid body motion, Lagrangian and Hamiltonian mechanics, coupled oscillations, and continuous systems. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Spring Prerequisites: PH 3110

PH 3210 Geometrical and Physical Optics An introduction to geometrical and physical optics. Topics in geometrical optics include ray analysis of mirrors, lenses, prisms, and optical systems. Topics in physical optics include polarization, interference, interferometry, and diffraction. The laboratory explores optics through experiments in imaging, fiber optics, interferometry, diffraction, polarization, and laser beam propagation. Credits: 4.0 Lec-Rec-Lab: (3-0-3) Semesters Offered: Fall; Prerequisites: PH 2400 and (MA 3530C or MA 3530C) or permission of instructor

PH 3300 Thermodynamics and Statistical Mechanics Thermodynamic systems, heat, work, laws of thermodynamics, formal mathematical relations, cycles, phase equilibrium, and multicomponent systems. Elementary kinetic theory. Introduction to microscopic view of entropy, ensemble theory, and applications of statistical mechanics. Credits: 3.0 Lec Rec-Lab: (3-0-0) Semesters Offered: Spring Prerequisites: PH 2300

PH 3410 Quantum Physics I An introduction to the foundations of modern physics and Schrödinger's wave mechanics. Topics include thermal radiation, particle-like properties of radiation, Bohr's model of the atom, matter waves, Schrödinger's wave mechanics, quantization of angular momentum, and the one-electron atom. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Fall; Prerequisites: PH 2400 and (MA 3520 or MA 3530) or permission of instructor

PH 3411 Quantum Physics II A continuation of PH 3410. Includes the study of spin and magnetic interactions, multi-electron atoms, quantum statistics, molecules, solids, and elementary particles. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Spring Prerequisites: PH 3410

PH 3440 Nuclear Radiation Measurements Theory and laboratory practice in the detection and characterization of nuclear radiation. Performs counting statistics and error analysis as key elements in interpretation of results. Emphasizes radiation safety and compliance with federal regulations. Credits: 1.0 Lec-Rec-Lab: (0-0-3) Semesters Offered: Fall Restrictions: Must be enrolled in one of the following Class(es): Senior

PH 3480 Modern Physics Laboratory Advanced laboratory techniques emphasized in a series of experiments in modern physics. Credits: 2.0 Lec-Rec-Lab: (0-0-6) Semesters Offered: Spring Prerequisites: PH 2230 or permission of instructor

PH 3600 Introduction to Remote Sensing Concepts of remote sensing. Introduces radiation, remote-sensing instrumentation, including multispectral and hyperspectral sensors, earth resource satellites, and image interpretation and processing. Presents applications of specific projects in biology, chemistry, civil engineering, electrical engineering, forestry, geophysics, and physics. Credits: 2.0 Lec-Rec-Lab: (2-0-0) Semesters Offered: Fall Restrictions: Permission of instructor required; must be enrolled in one of the following Major(s): Applied Geophysics, Civil Engineering, Electrical Engineering, Environmental Engineering, Geology, Geophysics, Forestry, Forest Science. Applied Imaging Systems, Biological Sciences, Chemistry Physics; must be enrolled in one of the following Class(es): Junior Senior Corequisites: UN 4000

PH 4010 Senior Physics Colloquium I Class discussion of the literature in the field of physics. Requires oral and written presentations. Credits: 1.0 Lec-Rec-Lab: (0-0-3) Semesters Offered: Fall Restrictions: Must be enrolled in one of the following Class(es): Senior

PH 4011 Senior Physics Colloquium II A continuation of PH 4011. Class discussion of current literature and recent advances in physics. Requires oral and written presentations. Credits: 1.0 Lec-Rec-Lab: (0-0-3) Semesters Offered: Spring Prerequisites: PH 4010 or permission of instructor

PH 4050 Qualitative Methods in Physics General methods and approaches of the physicist, including modeling, scaling, numerical estimation, and dimensional analysis as applied to the development, understanding, and solution of physics problems. Credits: 1.0 Lec-Rec-Lab: (0-1-0) Semesters Offered: Fall Restrictions: Must be enrolled in one of the following Major(s): Applied Physics, Physics; must be enrolled in one of the following Class(es): Senior

PH 4080 Senior Research I Introduction to research under the guidance of a faculty member. In addition, creative problem solving will be assessed via a student-initiated project. Credits: 3.0 Lec-Rec-Lab: (0-0-6) Semesters Offered: Fall Spring Summer Prerequisites: PH 3480

PH 4081 Senior Research II Continuation of research under the guidance of a faculty member, culminating in a written report and presentation of results at an undergraduate research forum. Credits: 3.0 Lec-Rec-Lab: (0-0-6) Semesters Offered: Spring Prerequisites: PH 4080

PH 4090 Senior Thesis Students prepare an in-depth written thesis on an approved topic in physics. Normally taken the last semester before graduation in conjunction with PH 4081. Credits: 1.0 Lec-Rec-Lab: (0-0-3) Semesters Offered: Spring Restrictions: Permission of instructor required

PH 4210 Electricity and Magnetism I Intermediate study of the basic theory of electricity and magnetism, including a detailed study of electrostatic field theory and an introduction to magnetostatics. Credits: 3.0 Lec-Rec-Lab: (3-0-3) Semesters Offered: Fall; Prerequisites: PH 2200 or PH 2200H and PH 3110 and (MA 3520 or MA 3530)

PH 4211 Electricity and Magnetism II A continuation of PH 4210. Intermediate study of magnetostatics, electrodynamics, and electromagnetic waves. Credits: 3.0 Lec-Rec-Lab: (3-0-3) Semesters Offered: Spring Prerequisites: PH 4210

PH 4380 Computers in the Physics Lab How computers are used for data acquisition, data treatment and analysis, graphics display, and controlling experiments. Develops skills necessary to interface and automate instruments and systems. Credits: 2.0 Lec-Rec-Lab: (0-0-5) Semesters Offered: Fall; Prerequisites: PH 2230 and CS 1010 or permission of instructor

PH 4390 Computational Methods in Physics Develops the use of UNIX/Prolog/CI for problem solving through direct experience with problems in mechanics, electromagnetism, and quantum mechanics. Additionally, assigned problems will lead to an understanding of why an "error-free" program does not guarantee meaningful results. Credits: 2.0 Lec-Rec-Lab: (2-0-0) Semesters Offered: Fall Restrictions: PH 3410 or permission of instructor

PH 4395 Computer Simulation in Physics Role of computer simulation in physics with emphasis on methodologies, data and error analysis, approximations, and potential pitfalls. Methodologies may include Monte Carlo simulation, molecular dynamics, and first-principles calculations for materials, astrophysics simulation, and biophysics simulations. Credits: 3.0 Lec-Rec-Lab: (1-0-4) Semesters Offered: Spring Prerequisites: (PH 3300 or PH 5310) and PH 4390 and (PH 2400 or PH 4340) or permission of instructor

PH 4430 Introduction to Nuclear Physics Ground state properties of stable nuclei of atoms; modes of disintegration of unstable nuclei; elementary theories of alpha, beta, and gamma decay; and nuclear reactions, including fission and fusion. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Spring Prerequisites: PH 3410 or CH 3520 or permission of instructor

PH 4510 Introduction to Solid State Physics Crystal structures, X-ray diffraction, phonons, free electron theory of metals, rudiments of band theory, an overview of semiconductors, and other topics in solid-state physics. Credits: 2.0 Lec-Rec-Lab: (2-0-0) Semesters Offered: Fall; Prerequisites: PH 2300 and PH 2400 and CH 1110 and (MA 3520 or MA 3530) or permission of instructor
PH 4610 Stellar Astrophysics Topics include an overview of observational astrophysics, stellar atmospheres, stellar structure, atomic properties of matter, radiation and energy transport in stellar interiors, and stellar evolution to and from the main sequence. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Spring; offered alternate years beginning with the 2000–01 academic year Prerequisites: PH 1600 and PH 2300 and (MA 3520 or MA 3530) or permission of instructor

PH 4620 Galactic Astrophysics Topics include the composition and dynamics of our galaxy, dynamics of stellar encounters, spiral density wave theory, clusters of galaxies, theoretical cosmology, physics of the early universe, and observational cosmology. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Spring; offered alternate years beginning with the 2001–02 academic year Prerequisites: PH 1600 and PH 2300 and (MA 3520 or MA 3530) or permission of instructor

PH 4640/GE 4640 Meteorology Essential elements of atmospheric physics and meteorology including atmospheric composition and structure, atmospheric thermodynamics, radiative transfer, atmospheric fluid dynamics, and cloud physics. In addition to the prerequisites, PH2300 and MA4515 are recommended, but not required. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Fall; offered alternate years beginning with the 2001–02 academic year Prerequisites: (PH 2200 or PH 2200H and (MA 3150 or MA 3160) and (MA 3520 or MA 3530) or permission of instructor

PH 4999 Special Topics in Physics Selected additional topics in physics for advanced students based on interests of faculty and students. Interested students should contact the physics department. Credits: variable to 9.0; may be repeated Lec-Rec-Lab: (0-0-0) Semesters Offered: Fall Spring Summer Restrictions: Permission of instructor required

Psychology (PSY)

PSY 2000 Principles of Psychology Introduction to the scientific study of psychological structures and processes involved in individual and group behavior. Explores theoretical accounts of the foundations of human behavior and examines empirical support. Topics include personality, disorders, therapy, development, and social psychology, perception, learning, cognition, emotion, and states of consciousness. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Fall Spring

PSY 2050 History and Systems of Psychology Traces major historical contributions to current psychology from ancient to modern times. Examines significant ideas and discoveries from philosophy, mathematics, the natural and medical sciences as they relate to the development of psychology. Discusses philosophical, theoretical, and methodological controversies that surfaced as part of these historical developments. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: On Demand Prerequisites: PSY 2000 and (UN 1002 or UN 1003)

PSY 3010 Theories of Personality Introduction to the variety of approaches to personality that underlie many clinical models. Discusses the formulation of personality theory, its purpose, and problems associated with personality theory generation. Emphasizes classical and contemporary theories of personality; their various applications to human behavior, and a review of relevant research findings. Credits: 3.0 Lec-Rec-Lab: (3-0-3) Semesters Offered: Fall Spring Prerequisites: PSY 2000 and (UN 1002 or UN 1003)

PSY 3030 Abnormal Psychology Helps the student build an understanding of abnormal behavior through critical examination of the variety of historical and contemporary models used in this field. The student learns the causes and treatment proposed by these models with an emphasis on the dominant medical model of psychiatric diagnosis. Credits: 3.0 Lec-Rec-Lab: (3-0-3) Semesters Offered: Spring Restrictions: May not be enrolled in one of the following Classes: Freshman Prerequisites: PSY 2000 and (UN 1002 or UN 1003)

PSY 3050 Developmental Psychology A survey of human development across the life span (prenatal, infant, child, adolescent, and adult) in the areas of biological, cognitive, social, emotional, and personality development. Provides students with insight into both the universality of human development and the uniqueness of individuals. Credits: 3.0 Lec-Rec-Lab: (3-0-3) Semesters Offered: Spring Prerequisites: PSY 2000 and (UN 1002 or UN 1003)

PSY 3070 Cross-Cultural Psychology Examines the ways that culture affects behavior and how cultural diversity is reflected in the workplace. Introduces a sampling of cultural differences that can impact both professional and personal lives. Students gain understanding of behaviors that are universal across cultures. Credits: 3.0 Lec-Rec-Lab: (3-0-3) Semesters Offered: Spring Prerequisites: PSY 2000 and (UN 1002 or UN 1003)

PSY 4000 Experimental Methods and Statistics Introduction to experimental design, general research methodology, and the analysis and interpretation of data. Emphasizes issues and methods involved in psychological research. Topics include descriptive and inferential statistics, experimental design and validity, analysis of variance, and correlation with regression. Each statistical method is also executed using computers. Credits: 3.0 Lec-Rec-Lab: (3-0-3) Semesters Offered: Fall Prerequisites: PSY 2000 and (UN 1002 or UN 1003)

PSY 4010 Cognitive Psychology A systematic survey of classical and contemporary research topics in human information processing and learning. Topics include models of cognition, perception, pattern recognition, attention, memory, representation and processing; the architecture of memory, imagery, concepts, and prototypes; reasoning, decision making, problem solving, and cognitive development. Credits: 3.0 Lec-Rec-Lab: (3-0-3) Semesters Offered: Fall Prerequisites: PSY 2000 and (UN 1002 or UN 1003)

PSY 4050 Psychology of Science and Technology Applies cognitive psychology to the endeavors of science, invention, and innovation. This examination of discovery and invention includes creativity, problem solving, attention, hypothesis formation, hypothesis testing, the use of mental models, and the use of thought experiments. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Spring Restrictions: May not be enrolled in one of the following Classes: Freshman Prerequisites: PSY 2000 and UN 2002

PSY 4090 Independent Study in Psychology Designed to allow students to participate in independent readings and research in a variety of areas within psychology. Credits: variable to 3.0; repeatable to a max of 9 Lec-Rec-Lab: (0-0-0) Semesters Offered: On Demand Restrictions: Must be enrolled in one of the following Class(es): 3.0 Lec-Rec-Lab: (0-0-2) Semesters Offered: Fall Restrictions: Must be enrolled in one of the following Major(s): General Studies, Sciences/Arts Undeclared

Social Sciences (SS)

SS 1001 Orientation to the Social Sciences Introduction to departmental requirements, relevant university resources, careers in social sciences and history, skill expectations, and portfolio development; assessment of current knowledge. Credits: 1.0 Lec-Rec-Lab: (1-0-0) Semesters Offered: Fall Spring; offered alternate years beginning with the 2000–01 academic year

SS 1002 Orientation to Legal Careers An introduction to how one becomes an attorney, what it is like to be an attorney, and the career options available to attorneys. Credits: 1.0 Lec-Rec-Lab: (1-0-0) Semesters Offered: Spring

SS 2100 World Peoples Environments Introduction to two major disciplines, anthropology and geography, that focus on human nature and the human relationship to environment and resources. Emphasizes patterns of culture and nature at different scales of human organization. Credits: 3.0; repeatable to a max of 9 Lec-Rec-Lab: (3-0-0) Semesters Offered: Fall

SS 2200 Prehistory and Archaeology Introduction to the methods of archaeology and the contributions of the discipline to understanding of world prehistory. Topics include the ways archaeologists discover and excavate sites, the analysis of archaeological artifacts and features, human evolution and the patterns of world prehistory. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Fall

SS 2500 The American Experience Covers selected topics related to historical development of American culture and society. Topics include American Revolution, slavery and Civil War, Jacksonian democracy, the West, urbanization and immigration, technology, work, Progressive and expertise, World War I, wealth and leisure, Americans and politics, mass communications and media, and the Great Depression. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Fall

SS 2550 Themes in Western Civilization Overview of the evolution of Western civilization. Reviews the major themes and movements that have influenced Western civilization, the factors that have contributed to its distinctiveness, and its impact on other civilizations. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Fall

SS 2600 American Government Politics Outlines the principles and logic of American Government and politics and explores contemporary issues in national and state government. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Spring

SS 2700 Introduction to Sociology Introduces students to the way that sociologists think about different components of society. Topics include the family, religion, markets, organizations, political systems, and educational systems. Also covers the source of individual values, beliefs, and attitudes. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Fall

SS 2800 Science, Technology, Society The impacts of science and technology on society and the environment, and the shaping of science and technology to meet human needs. Topics may include effects of technologies, such as computers, biotechnology, and chemicals, on society and nature; science and technology policy; the history of technology and its global consequences. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Fall

SS 3100 Developing Societies An overview of the developing world. Asks what is development? in ecological, human, and economic terms. Explores variation among developing societies and elements of internal differentiation, including cultures, regions, classes, and genders. Emphasizes active student exploration of strategies for change, including technology, business, and political transformations. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Spring; offered alternate years beginning with the 2000–01 academic year Prerequisites: UN 1002 or UN 1003

SS 3200 Historical Archaeology Introduction to historical archaeological archaeology. Topics include the methods of historical archaeology, theoretical approaches, and sources of evidence. Emphasizes archaeological contributions to understanding of the American past, and the contributions of historical archaeology to an alternative view of American history and culture. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Spring Prerequisites: UN 1002 or UN 1063 or permission of instructor
Course Descriptions

SS 3210 Field Archaeology  Practical experience and training in the methods and techniques of field archaeology. Selected readings are followed by active participation in site survey, testing, excavation, record keeping, and analysis. Students benefit through involvement in ongoing research projects. Credits: variable to 8.0 Lec-Rec-Lab: (0-0-0) Semesters Offered: Summer Prerequisites: UN 1002 or UN 1003

SS 3220 Archaeology Laboratory Methods  Introduction to archaeological laboratory methods and the analysis of archaeological materials. Using a hands-on approach, the class emphasizes preserving, identifying, documenting, and interpreting artifacts and ecofacts from local and regional archaeological sites. Credits: 4.0 Lec-Lab: (0-3-3) Semesters Offered: Fall; Prerequisites: SS 2200 and (UN 1002 or UN 1003) or permission of instructor

SS 3230 Archaeology of Industry  The study of industrial heritage using archaeological and historical perspectives. Covers theories, methods, and techniques by means of lectures, readings, and case studies. Students conduct original research, generally on Copper Country industrial sites, under the guidance of the instructor. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Spring Prerequisites: UN 1002 or UN 1003

SS 3300 Environmental Problems  Examination of local, regional, and global contemporary environmental problems. Critical consideration of underlying social, historical, and economic causes. Case studies drawn from topics such as global warming, ozone depletion, groundwater pollution, solid waste disposal, deforestation, and resource depletion. Studies proposed solutions and their impacts. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Spring Prerequisites: UN 1002

SS 3400 Contemporary Europe  Examination of the landscapes and cultures of modern Europe. Emphasizes cultural patterns and diversity, environmental quality, economic development, and forces of economic and political unification. Examines urbanization, industry, population, nationalism, and political change through regional examples. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Fall; Prerequisites: UN 1002 or UN 1003

SS 3410 World Resources Development  Examination of the human geography and resources of various world regions. Emphasizes factors affecting prospects for development, including population dynamics, natural resource endowment, social and cultural systems, and spatial structure of society. Case studies of individual countries supplement general concepts and theories. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Fall; Prerequisites: UN 1002 or UN 1003

SS 3500 Modern American History  A broad survey of American history from World War II to the present. Credits: 3.0 Lec-Rec-Lab: (2-0-3) Semesters Offered: Spring Prerequisites: UN 1002 or UN 1003

SS 3505 Military History of the U.S.  History of the American military and its place in American society in both peace and war from the colonial period until the present. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Spring Prerequisites: UN 1002 or UN 1003

SS 3510 History of American Technology  Survey of the technological changes that transformed a rural, agrarian America into an urban, industrialized nation. Focuses on how America’s social values and geographical situation influenced the direction taken by its technology and engineering community and how America’s industrialization, in turn, had significant effects on American society. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Spring Prerequisites: UN 1002 or UN 1003

SS 3511 History of Science in America  Examines the development of scientific enterprises in the U.S. from the colonial period through the present day. Emphasizes institutional bases of science and the place of scientific activities within American society. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Fall; Prerequisites: UN 1002 or UN 1003

SS 3515 History of American Architecture  Survey of North American architecture from prehistoric times to the present. Focuses on principal architectural styles, building types, and construction technologies. Also examines ideas about architecture to understand the American past. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Spring Prerequisites: UN 1002 or UN 1003

SS 3520 U.S. Environmental History  Examines how human interaction with physical environment has changed in North America over the last four centuries. Topics include uses of land by Native Americans, changes associated with European colonization, incorporation of natural resources into industrial economy, early conservation and preservation movements, and environmental concerns accompanying urbanization and industrialization. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Spring; Prerequisites: UN 1002 or UN 1003

SS 3530 The Automobile in America  Examines the automobile in diverse ways, seeing it as a complex product to be manufactured, as a stimulus to reshaping the environment, as an object that has altered social behavior, and as a problem solver and problem maker. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Spring Prerequisites: UN 1002 or UN 1003

SS 3540 History of Michigan  The history of Michigan from before European settlement to the present. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Spring; Prerequisites: UN 1002 or UN 1003

SS 3541 The Copper Country  Examines the social, labor, and technological history of the Copper Country from the frontier era until the shutdown of the mines. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Spring Prerequisites: UN 1002 or UN 1003

SS 3550 Europe to 1650  History of Europe from earliest times to 1650. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Fall; Prerequisites: UN 1002 or UN 1003

SS 3551 Europe in the Modern Era  A study of European history from 1650 to the present. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Spring Prerequisites: UN 1002 or UN 1003

SS 3552 Renaissance Reformation  The history of Europe from 1300 to 1650. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Spring Prerequisites: UN 1002 or UN 1003

SS 3560 History of England I  The social, economic, and political history of England to 1714. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Spring Prerequisites: UN 1002 or UN 1003

SS 3561 History of England II  History of England from 1714 to the present, including political, social, and economic developments in the period of Britain’s greatest influence in the world. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Spring Prerequisites: UN 1002 or UN 1003

SS 3570 History of Canada  Political, social, economic, and cultural development of Canada from earliest European settlement to the present. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Spring Prerequisites: UN 1002 or UN 1003

SS 3580 Technology and Western Civilization  Overview of the evolution of technology in Western civilization from classical antiquity to mid-twentieth century. In addition, the course looks at ways technology influenced development of Western civilization and ways values of Western civilization have conditioned Western technology. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Spring; Prerequisites: UN 1002 or UN 1003

SS 3600 American Foreign Policy  Explores the nature, sources, and institutions associated with the making of American foreign policy, paying attention to explanations for American behavior and to current problems for policy. Reviews major events in U.S. diplomatic history. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Spring; Prerequisites: UN 1002 or UN 1003

SS 3610 International Law  Explores the principles, content, and logic of public international law, the law of nations. Students brief cases, prepare longer briefs to defend a side in a moot court. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Spring; Prerequisites: UN 1002 or UN 1003

SS 3620 International Technology Policy  Explores the relationship between markets and government policies in moving national economies and corporations towards “greener” technology choices. Topics may include industrial ecology, regulation, innovation, pollution prevention. Course employs examples from U.S., Canada, EU, and Japan. When possible, students work on a real-life project for a client. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Spring; Prerequisites: UN 1002 or UN 1003

SS 3630 Environmental Policy and Politics  A broad survey of how environmental policy making actually works in the U.S. Covers both environmental policy processes and politics, and the major environmental policies themselves for control of air pollution, water pollution, hazardous wastes, and other major environmental problems. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Spring Prerequisites: UN 1002 or UN 1003

SS 3700 Industry and Society  Examines how the development of modern industry has transformed society by creating a new class of individuals-industrial workers, a new form of the enterprise-the modern industrial enterprise, and a new form of the state-the industrial state. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Spring Prerequisites: UN 1002 or UN 1003

SS 3710 Social Problems  Examines both the social construction of social problems and substantive problems confronting modern society by considering the distinct understandings of social problems offered by the two major theoretical traditions in sociology and analyzing specific macro and micro social problems. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Spring Prerequisites: UN 1002 or UN 1003

SS 3720 Social Psychology  Survey of social and cognitive influences on individual and group behavior. Introduces attitude formation, social conformity, personal perception, aggression, cooperation, and interpersonal and intergroup relations. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Spring Prerequisites: UN 1002 or UN 1003

SS 3740 Sociology of the Family  Survey of marital and family relationships, which includes an examination of sex roles, courtship and mate selection, marital adjustment, sexual behavior, parenting, divorce, and the social forces that bring about changes in family patterns. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Spring Prerequisites: UN 1002 or UN 1003
SS 3750 Social Inequality  Critical assessment of social and cultural processes associated with group-based or categorical patterns of inequality. Examines the creation, persistence, and attempts at reduction of structured inequality based on categorical factors such as social class, race, ethnicity, and gender. May explore other significant sources of social inequality. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Spring; offered alternate years beginning with the 2001–02 academic year Restrictions: May not be enrolled in one of the following class(es): Freshman Prerequisites: UN 2002

SS 3760/FW 3760 Human Dimensions of Natural Resources  Uses sociological concepts to cover facets of human relationships to natural resources, including human values, beliefs, and attitudes regarding the environment; rural resource-dependent communities; natural resource professions and expert knowledge; and the history of American perspectives on the environment. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Fall Prerequisites: UN 2002

SS 3800 Energy Technology and Policy  The many roles of energy in our energy-dependent world, focusing on fuel and technology choices, trends, and policies. Emphasizes current energy dilemmas and environmental challenges, such as the risk of global climate change. Field trips to local solar homes and energy companies. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Spring; offered alternate years beginning with the 2000–01 academic year Prerequisites: UN 2002 or permission of instructor

SS 3810 Culture, Science Technology  An anthropological study of technological developments and scientific knowledge in different cultures. Examines how modes of thought in the 20th century have influenced the development of science and technology in the West. Utilizes case studies from anthropology to compare Western and non-Western approaches to scientific observation and technological change. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Spring; offered alternate years beginning with the 2001–02 academic year Restrictions: May not be enrolled in one of the following class(es): Freshman Prerequisites: UN 2002

SS 3850/BL 3850 Environmental Toxicology and Society  Investigates the social consequences of environmental poisons on human health and communities, with a focus on global effects and the unequal burden of toxic exposure. Toxicology lectures cover testing methods, bioactivation, carcinogetic and teratogenic effects, and target organs. Discussion covers case studies of community poisoning, toxic regulation, and political debate. Credits: 3.0 Lec-Rec-Lab: (3-2-0) Semesters Offered: Spring; offered alternate years beginning with the 2000–01 academic year Restrictions: May not be enrolled in one of the following class(es): Freshman Prerequisites: UN 2002

SS 3890 Industry the World Economy  Examines the impact of industry and industrial transformations at the local, regional, state, national, and global level. Analyzes topics such as the process of technological transformation, the modern corporation, the environmental consequences of industry, and the corporation and the nation state. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Fall Prerequisites: UN 2002

SS 3910 Histories and Cultures  Covers selected topics in world history, geography, or anthropology. Important concepts are the relationship between societies and regional geography, the sources and patterns of major cultures, and transformations of social, cultural, political, and economic institutions over time. May be repeated if topic differs. Credits: 3.0; repeatable to a max of 9 Lec-Rec-Lab: (3-0-0) Semesters Offered: On Demand Prerequisites: UN 1002 or UN 1003

SS 3920 Topics in Archaeology  Survey of a major branch of American archaeology or a specific time period or region. Topics may include North American prehistory, experimental archaeology, ancient metallurgy, or other specialized themes. Readings will emphasize both theoretical and substantive contributions. May be repeated if topic differs. Credits: 3.0; repeatable to a max of 9 Lec-Rec-Lab: (3-0-0) Semesters Offered: On Demand Prerequisites: UN 1002 or UN 1003

SS 3930 Environmental Issues  Covers different environmental issues from year to year. Examples include air pollution, water pollution, endangered species, public land management, and toxics. Each course provides an in–depth exposure to the course topic, covering its sociopolitical and environmental components. May be repeated if topic differs. Credits: 3.0 May be repeated Lec-Rec-Lab: (3-0-0) Semesters Offered: On Demand Prerequisites: UN 2002

SS 3940 World Affairs  The study of current issues and themes in world affairs and of significant world tension areas. Detailed examination of central issues in selected recent regional or international conflicts or high profile internal problems in selected countries. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: On Demand Prerequisites: UN 2002

SS 3950 Topics in American History  Examines an important theme, topic, or era in the development of American society, ranging from the colonial era up to the present. May include such topics as the Vietnam War, sports in America, American vernacular architecture, or urban America, all from a historical viewpoint. May be repeated if topic differs. Credits: 3.0; repeatable to a max of 9 Lec-Rec-Lab: (3-0-0) Semesters Offered: On Demand Prerequisites: UN 1002 or UN 1003

SS 3960 International Experience  Offers a means for crediting students for specific activities in study abroad programs that immerse them in foreign culture, society, and intellectual settings. It is applicable to varied study abroad and exchange programs offered by MTU. Credits: variable to 9.0; repeatable to a max of 9 Lec-Rec-Lab: (0-0-0) Semesters Offered: On Demand

SS 3990 Topics in the Social Sciences  Examines an important theme or topic in the social sciences, such as social theory, work and society, or the engineer in American society. May be repeated if topic differs. Credits: 3.0; repeatable to a max of 9 Lec-Rec-Lab: (0-3-0) Semesters Offered: On Demand Prerequisites: UN 2002

SS 4000 Independent Study  Independent study of topic of special interest with assistance and supervision from appropriate faculty. Credits: variable to 3.0; repeatable to a max of 9 Lec-Rec-Lab: (0-0-0) Semesters Offered: On Demand Restrictions: Permission of instructor required

SS 4010 Social Science Methods  Covers basic concepts and methods used in conducting empirical research in the social sciences. Topics include research design, hypothesis testing, measurement of concepts, and computer-based data analysis. Credits: 4.0 Lec-Rec-Lab: (3-1-0) Semesters Offered: Spring; offered alternate years beginning with the 2000–01 academic year Restrictions: May not be enrolled in one of the following class(es): Freshman Prerequisites: UN 2002

SS 4100 American Indian Political Issues  Exploration of contemporary relationships among American Indians and members of non-Indian communities, focusing on economic resource issues and on the relationship between tribes and other political entities, with emphasis on the Great Lakes region. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Spring; offered alternate years beginning with the 2000–01 academic year Prerequisites: UN 2002

SS 4500 Historiography  The history of historical writing from Herodotus to the present. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Fall; offered alternate years beginning with the 2001–02 academic year Prerequisites: UN 1002 or UN 1003

SS 4900 Seminar in Social Sciences  An intensive seminar study of a topic of importance and special interest in the social sciences. Topics could focus on the history of anthropological theory or on world religious systems in comparison. May be repeated if topic differs. Credits: 3.0; repeatable to a max of 9 Lec-Rec-Lab: (3-0-0) Semesters Offered: On Demand Prerequisites: UN 2002

SS 4910 Senior Orientation and Assessment  Assessment of learning and preparation for post-graduate work, professional training, or graduate school. Credits: 1.0 Lec-Rec-Lab: (1-0-0) Semesters Offered: Spring Restrictions: Must be enrolled in one of the following Major(s): Social Sciences, Liberal Arts with History Option; must be enrolled in one of the following class(es): Junior Senior

SS 4920 Internship Experience  Internship, on or off campus, providing appropriate practical, professional experience in an area related directly to a student’s course of study. Students work under professional supervision. Requires a written evaluation of the work. Credits: variable to 6.0; repeatable to a max of 6 Lec-Rec-Lab: (0-0-0) Semesters Offered: On Demand Restrictions: Permission of department required; must be enrolled in one of the following Major(s): Social Sciences, Liberal Arts with History Option

Surveying (SU)

SU 1100 Introduction to Surveying and Mapping  A brief exploration of the surveying profession and the variety of tasks involved in it. Students will perform simple field surveying and mapping projects without the use of electronic equipment. Emphasizes understanding and applying basic measurement theories and techniques. Credits: 2.0 Lec-Rec-Lab: (0-1-0) Semesters Offered: Fall

SU 1300 Surveying Field Fundamentals  Accelerated two-week course, meeting 48 hours per week. An orientation and introduction to proper field surveying techniques. Emphasizes accuracy and precision of linear and angular measurements. Offered immediately following spring semester and immediately prior to fall semester. Credits: 2.0 Lec-Rec-Lab: (0-0-48) Semesters Offered: Summer Restrictions: May not be enrolled in one of the following Major(s): Surveying

SU 2100 Surveying Fundamentals  Introduction to surveying principles as applied to the measurement of distances, directions, and elevations. Topics include taping, leveling, traversing, topographic surveys, construction surveys, U.S. public land surveys, the use of modern instrumentation, and computer applications. Credits: 3.0 Lec-Rec-Lab: (0-0-3) Semesters Offered: Fall Restrictions: Permission of instructor required Corequisites: SU 2110 Prerequisites: SU 1100(C)

SU 2110 Surveying Fundamentals Laboratory  Introduction to proper field procedures and techniques as applied to the measurement of distances, directions, and elevations. Exercises include taping, leveling, traversing, topographic surveys, construction surveys, the use of modern instrumentation, and computer applications. Credits: 2.0 Lec-Rec-Lab: (0-0-6) Semesters Offered: Fall Restrictions: Permission of instructor required Corequisites: SU 2100 Prerequisites: SU 1100(C)

SU 2220 Route and Construction Surveying  Study of the geometry and field stake-out techniques of circular curves, spiral curves, compound curves, reverse curves, equal-tangent vertical curves, unequal-tangent vertical curves, and slope staking. Other topics include horizontal and vertical alignment design, highway drainage, and earthwork quantities and mass diagrams. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Fall Restrictions: Permission of instructor required Prerequisites: SU 2100

SU 2240 Real Estate Law  Introduction to basic concepts of land and land ownership. Topics include sources and purpose of law, water rights, shared ownership concepts, easements, land record systems, legal descriptions, land transaction mechanics and the real estate industry, governmental and private limits on property rights. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Spring
SU 2310 Surveying Field Practice I  Accelerated 6-week course. Introduces students to the basic measurements and equipment used in surveying as well as typical surveying techniques. Field exercises include traversing, leveling, mapping, horizontal curves, and related computations. Credits: 6.0 Lec-Rec-Lab: (0-6-0) Semesters Offered: Summer Restrictions: May not be enrolled in one of the following Classes(s): Freshman Prerequisites: SU 2220 and SU 2240 and CTE 2100 or permission of instructor

SU 2320 Surveying Field Practice II  Accelerated 6-week course and is the second of a two-course sequence that introduces students to practical, project-oriented aspects of surveying. Credits: 6.0 Lec-Rec-Lab: (0-9-0) Semesters Offered: Summer Prerequisites: SU 2310 or permission of instructor

SU 3100 Spatial Data Collection and Mapping  Use of electronic data collectors with total stations. Processing of data through data collection software to produce engineering drawings and maps using CAD. Credits: 2.0 Lec-Rec-Lab: (0-1-3) Semesters Offered: Fall Restrictions: Permission of instructor required Prerequisites: SU 2100 and CTE 2100

SU 3150 Principles of Geodesy  Concepts of astronomy and geodesy that are relevant to the practice of surveying. Covers theory, field techniques, and computations involved in the determination of true north, an introduction to the figure of the earth and its geometric and physical characteristics, geodetic datums, and coordinate systems. Credits: 4.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Spring Restrictions: Must be enrolled in one of the following Class(es): Junior Senior Prerequisites: MAT 1125 and SU 2320 or permission of instructor

SU 3180 Boundary Surveying Principles  Legal principles used to establish land boundaries and to resolve conflicts between boundary descriptions as well as conflicts between evidence. Covers legal doctrines for transferring title by adverse possession; the role of the surveyor in issuing opinions as to boundary location and in resolving boundary disputes. Several requisites; see instructor: Credits: 3.0 Lec-Rec-Lab: (2-0-3) Semesters Offered: Fall Prerequisites: UN 2001 and SU 2230 and SU 2240

SU 3200 Photogrammetry  Basic principles of photogrammetry and its role as a technology for spatial data collection. Impact of photogrammetry in the fields of surveying, engineering, and geographic information management. Presents a brief introduction to remote sensing. Credits: 3.0 Lec-Rec-Lab: (0-2-3) Semesters Offered: Spring Restrictions: Must be enrolled in one of the following Class(es): Junior Senior Prerequisites: SU 3230 or permission of instructor

SU 3250 Survey Measurements and Adjustments  Presents errors in surveying measurements and their effect on computed values. Discusses analysis of measurements and errors based on statistical principles and presents adjustment techniques based on least squares principle. Credits: 3.0 Lec-Rec-Lab: (2-0-2) Semesters Offered: Fall Restrictions: Must be enrolled in one of the following Classes(s): Junior Senior Prerequisites: MA 2320 and SU 2320 and MA 2710

SU 3280 Land Divisions and Development  Introduces the physical, economic, and social aspects of optimum land-use densification. Introduces local and state regulation of land divisions, condominiums, mobile home parks, and subdivisions. Credits: 3.0 Lec-Rec-Lab: (2-0-3) Semesters Offered: Spring Prerequisites: UN 2001 and SU 2320 and SU 2240 and HU 3120(C)

SU 4000 Special Projects in Surveying  A guided study or investigation in an area related to surveying approved by the instructor. Requires a study plan, report, and/or presentation. Credits: variable to 6.0 May be repeated Lec-Rec-Lab: (0-0-0) Semesters Offered: Fall Spring Restrictions: Permission of instructor required; must be enrolled in one of the following Class(es): Junior Senior

SU 4100 Advanced Surveying Techniques  Introduces the instruments and procedures used in surveying projects that require a high order of accuracy. Discusses some conventional instruments and techniques but the greater emphasis is on GPS techniques. Credits: 3.0 Lec-Rec-Lab: (0-2-3) Semesters Offered: Fall Restrictions: Must be enrolled in one of the following Class(es): Junior Senior Prerequisites: SU 3150 and SU 3250

SU 4200 Introduction to Geographic Information Systems  Covers fundamentals of geographic information systems (GIS). Focuses on the use of GIS in municipal administration. Introduces the concept of multipurpose datasets. Credits: 3.0 Lec-Rec-Lab: (0-2-3) Semesters Offered: Spring Prerequisites: SU 3200 or permission of instructor

SU 4250 Professional Practice: Surveying  Surveying as a licensed profession. Introduction to ethical and business issues involved in the surveying profession. Liability exposure of surveyors via contract, agency, and tort principles. Credits: 3.0 Lec-Rec-Lab: (2-0-3) Semesters Offered: Spring Restrictions: Permission of instructor required

Forestry Technology (TFR)

TFR 1115 Dendrology  A laboratory and field-oriented study of native and introduced trees and shrubs in the region and commercially important tree species in the U.S. Includes the use of keys in plant identification. Credits: 3.0 Lec-Rec-Lab: (0-2-4) Semesters Offered: Fall Restrictions: Must be enrolled in one of the following Major(s): Civil Engineering Technology, Forest Technology, Surveying

TFR 1116 Land Measurements and Computer  Basics Introduces basic computer literacy, including e-mail, word processing and the use of spreadsheet applications. Stresses the performance of basic field measurements involved in determining direction, distance, area and field location. Covers hand compassing, map reading, and pacing operations. Introduces use of GPS. Credits: 3.0 Lec-Rec-Lab: (0-2-3) Semesters Offered: Fall Restrictions: Permission of instructor and department required

TFR 1134 Forest Ecology-Soils  Introduces the principles of forest ecology and forest soils. Emphasizes the effects of the environment and soils on forest establishment, growth, and survival. Stresses field recognition of forest types associated with various site conditions in the laboratory. Credits: 4.0 Lec-Rec-Lab: (0-3-3) Semesters Offered: Fall

TFR 1235 Forest Measurements I  Introduces principles and practical field applications of basic forest measurement techniques. Emphasizes log scaling and standing tree evaluation. Integrates elementary statistical analysis and computer applications. Credits: 3.0 Lec-Rec-Lab: (0-2-2) Semesters Offered: Spring

TFR 1242 Forest Treatments I  The silvicultural applications used in forest establishment, growth regulation, and control of species composition and stand structure. Emphasizes forest treatments throughout the life of the stand from establishment to final harvest. Credits: 3.0 Lec-Rec-Lab: (0-2-3) Semesters Offered: Spring Prerequisites: TFR 1134 or permission of instructor

TFR 1251 Natural Resource Mapping  Introduces mapping applications used in the natural resource profession. Computer mapping includes emphasis of GIS and associated software application. Introduces the basics of aerial photo mapping techniques. Credits: 2.0 Lec-Rec-Lab: (0-1-3) Semesters Offered: Spring Prerequisites: SU 1100 and TFR 1116 or permission of instructor

TFR 2335 Forest Measurements II  The application of individual tree measurement techniques and cruising methods used in forest inventory practices. Students independently execute defined field projects and summarize field data in written reports. Credits: 4.0 Lec-Rec-Lab: (0-2-6) Semesters Offered: Fall Restrictions: Must be enrolled in one of the following Major(s): Forest Technology Corequisites: TFR 2342, TFR 2344 Prerequisites: TFR 1115 and TFR 1235 or permission of instructor

TFR 2342 Forest Treatments II  A field evaluation and application of various silvicultural treatments. Emphasizes timber marking techniques. Credits: 2.0 Lec-Rec-Lab: (0-0-6) Semesters Offered: Fall Restrictions: Permission of department required; must be enrolled in one of the following Major(s): Forest Technology Corequisites: TFR 2335, TFR 2361 Prerequisites: TFR 1242

TFR 2344 Timber Harvesting  A field-oriented course emphasizing timber sale layout and administration, stream crossing permitting, and BMP’s. Reviews efficient use of harvesting systems. Stresses safe use of timber harvesting equipment and operation. Credits: 4.0 Lec-Rec-Lab: (0-2-6) Semesters Offered: Fall Restrictions: Permission of department required; must be enrolled in one of the following Major(s): Forest Technology Corequisites: TFR 2335, TFR 2361 Prerequisites: TFR 1242

TFR 2345 Aerial Photos and Habitat Typing  Emphasizes field application of aerial photographs in forest type mapping. Covers recognition of habitat types in the Lake States. Credits: 2.0 Lec-Rec-Lab: (0-0-6) Semesters Offered: Fall Restrictions: Permission of department required; must be enrolled in one of the following Major(s): Forest Technology Corequisites: TFR 2342, TFR 2361 Prerequisites: TFR 1115 and TFR 1251

TFR 2361 Forest Protection  Introduces the identification, detection, prevention, and control of destructive forest agencies. Emphasizes field identification and effects of destructive forest agencies on trees. Credits: 3.0 Lec-Rec-Lab: (0-2-3) Semesters Offered: Fall Restrictions: Permission of department required; must be enrolled in one of the following Major(s): Forest Technology Corequisites: TFR 2342, TFR 2361 Prerequisites: TFR 1115 and TFR 1242

TFR 2444 Forest Products  Overview of common forest products and their manufacturing processes. Includes identification and physical properties of commercial wood species. Credits: 3.0 Lec-Rec-Lab: (0-2-3) Semesters Offered: Spring

TFR 2458 Forest Business Practices  Introduces the organization of a small forest enterprise, its related principles and regulations. Emphasizes recordkeeping and basic accounting. Credits: 3.0 Lec-Rec-Lab: (0-2-3) Semesters Offered: Spring

TFR 2461 Natural Resources Management and Current  Topics Overview of non timber-related natural resource management techniques. Emphasizes recreational and wildlife uses of forest land. Includes an overview of urban tree maintenance practices and selected current forestry topics. Credits: 4.0 Lec-Rec-Lab: (0-3-3) Semesters Offered: Spring

TFR 3370 Comprehensive Project  The student is assigned to a team that evaluates an assigned parcel of land. Students use skills learned in previous forestry courses. The comprehensive project is normally taken as two one-credit courses during the second year. Requires oral and written reports prior to course completion. Credits: variable to 2.0; repeatable to a max of 2 Rec-Lec-Lab: (0-0-0) Semesters Offered: Fall Spring Restrictions: Must be enrolled in one of the following Major(s): Forest Technology
University Wide (UN)

UN 1001 Perspectives on Inquiry Engages students in college level inquiry through which they develop fundamental intellectual habits, understand how to integrate perspectives on knowledge, and begin to learn how to meet the changing needs of a global, technological, diverse, and environmentally sensitive society. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Fall Spring Restrictions: Must be enrolled in one of the following Class(es): Freshman

UN 1002 World Cultures Examines diversity and change around the globe from perspectives of social sciences, humanities, and arts: explores human experience from prehistory to present. Classroom lectures accompanied by films, live performances, and guest speakers. One complete year of a single foreign language plus World Cultures (UN1003, 1-credit-activities) substitutes for World Cultures. Credits: 4.0 Lec-Rec-Lab: (4-0-2) Semesters Offered: Spring Restrictions: Must be enrolled in one of the following Class(es): Freshman

UN 1003 World Cultures Activities Activities portion of World Cultures. Limited to enrollment by students choosing the modern language option of one full year of a single foreign language to fulfill their World Cultures requirement. Credits: 1.0 Lec-Rec-Lab: (0-0-2) Semesters Offered: Spring Restrictions: Must be enrolled in one of the following Class(es): Freshman

UN 2001 Revisions Provides direct instruction in communication and strategies for revision. Writing portfolios provide a starting point for the course. Instruction in the composing process is often accompanied by work in small groups and conferences with the instructor. Credits: 3.0 Lec-Rec-Lab: (0-3-0) Semesters Offered: Fall Spring Restrictions: Must be enrolled in one of the following Class(es): Sophomore Prerequisites: UN 1001 and (UN 1002 or UN 1003)

UN 2002 Institutions From families to governments, to markets, to our interactions with the natural environment, institutions organize collective human action. Introduces students to the nature and role of institutions in shaping today’s world. Specific topics will vary by section, but all sections address a set of core questions and concepts. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Fall Spring Restrictions: May not be enrolled in one of the following Class(es): J junior Senior

UN 3002 Cooperative Laboratory Offered by each participating college or school— the free elective option of cooperative education. Requires 2.20 GPA or better, registration with the Office of Cooperative Education, acceptability by a recognized employer. In addition, transfer students must have completed at least one full-time semester on the MTU campus. Credits: 2.0; may be repeated Lec-Rec-Lab: (0-0-40) Semesters Offered: Fall Spring Restrictions: Permission of department required. May not be enrolled in one of the following Class(es): Freshman

UN 3003 Cooperative Laboratory Technical Elective Offered by each participating college or school— the technical elective option of cooperative education. Requires GPA 2.20 or better, registration with the Office of Cooperative Education, acceptability by a recognized employer. In addition, transfer students must have completed at least one full-time semester on the MTU campus. Credits: 3.0; may be repeated Lec-Rec-Lab: (0-0-40) Semesters Offered: Fall Spring Restrictions: Permission of department required. May not be enrolled in one of the following Class(es): Freshman

UN 4000 Remote Sensing Seminar A seminal series that covers topical issues in remote sensing, ecosystem research, and global change. Required for all students with a minor in remote sensing. Credits: 1.0; repeatable to a max of 2 Lec-Rec-Lab: (0-1-0) Semesters Offered: Fall Spring Restrictions: Must be enrolled in one of the following Class(es): J Junior Senior
Appendices

➤ A: Refund/Repayment Policies
➤ B. Satisfactory Progress Policy
➤ C. Scholarships and Loans
➤ D. MTU Faculty Emeriti
➤ E. University Information—Assessment, Leadership, Accreditation, Membership

Appendix A: Refund/Repayment Policies

Refunds of Tuition/Fees
Students will be assessed tuition according to the number of credits for which they are registered on the fifth day of instruction.

Note: The bursar shall determine whether extraordinary circumstances warrant exceptions to the refund policy in individual cases.

Credit Status Change—Refunds for enrolled students who change credit status downward or drop a course with a course/lab fee will have tuition and course/lab fees refunded according to the following schedule:

<table>
<thead>
<tr>
<th>Time of Status Change</th>
<th>Refund Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>On or before 5th day of class</td>
<td>100%</td>
</tr>
<tr>
<td>After 5th day of class</td>
<td>0%</td>
</tr>
</tbody>
</table>

Note: Accelerated courses and summer session adjustments of tuition assessments are calculated on a pro rata basis.

University Withdrawal—Students withdrawing from the University or dropping all courses will receive a refund according to the following schedule:

<table>
<thead>
<tr>
<th>Time of Withdrawal</th>
<th>Refund Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st week</td>
<td>90%</td>
</tr>
<tr>
<td>2nd week</td>
<td>80%</td>
</tr>
<tr>
<td>3rd week</td>
<td>70%</td>
</tr>
<tr>
<td>4th week</td>
<td>60%</td>
</tr>
<tr>
<td>5th week</td>
<td>50%</td>
</tr>
<tr>
<td>6th week</td>
<td>40%</td>
</tr>
<tr>
<td>7th week or later</td>
<td>0%</td>
</tr>
</tbody>
</table>

Room and Board Refunds—Refunds of room-and-board charges will be prorated on the basis of the number of weeks used.

Enrollment Deposit—The enrollment deposit is refundable within six months of leaving the University. Unpaid charges such as library fines, traffic fines, lab deposits, and other penalties shall be deducted from the refund of the deposit.

Financial Aid Refund Policy

Return of Title IV Funds
Students who completely withdraw from all courses prior to completing more than 60 percent of a semester will have their eligibility for aid recalculated based on the percent of the semester completed. This policy shall apply to all students who withdraw, drop out, or are dismissed from the University and receive financial aid from Title IV funds.

The term "Title IV Funds" refers to the following federal financial aid programs: Federal Direct Unsubsidized Loan, Federal Direct Subsidized Loan, Federal Direct PLUS Loan, Federal Perkins Loan, Federal Pell Grant, Federal Supplemental Educational Opportunity Grant and Leveraging Educational Assistance Partnership Grant (LEAP).

Title IV aid is earned in a prorated manner on a per diem basis up to and including the 60 percent point in the semester. Title IV funds and all other aid is viewed as 100 percent earned after that point in time.

The percentage of Title IV aid earned shall be calculated as follows:

\[
\text{Number of Days Completed by the Student} = \frac{\text{Percent of Title IV Aid Earned}}{\text{Total Number of Days in the Semester}}
\]

A student’s withdrawal date is determined by the University as (1) the date the student began the university’s withdrawal process or officially notified the Office of Records and Registration of intent to withdraw; or (2) the midpoint of the semester for a student who leaves without notifying the university; or (3) the student’s last date of attendance at a documented academically related activity.

University’s Portion to be Returned—The percentage of Title IV aid unearned (i.e., to be returned to the appropriate program) shall be 100 percent minus the percent earned. Any unearned aid to be returned by the University is the lesser of (1) the entire amount of unearned aid or (2) the total institutional charges multiplied by the percentage of unearned aid.

Unearned Title IV aid shall be returned according to the following priority up to the amount received for the semester:

1. Direct Unsubsidized Loan
2. Direct Subsidized Loan
3. Perkins Loan
4. Direct PLUS Loan
5. Pell Grant
6. Supplemental Educational Opportunity Grant
7. Other Title IV Grant or Loan Programs

Student’s Portion to be Returned—When the total amount of unearned aid is greater than the amount returned by the University from the student’s account, the student is responsible for returning unearned aid to the appropriate program(s). The same priority as above would be used. Any loan funds that must be returned by the student will be repaid according to the terms of the promissory note. There is a 50 percent discount on any grant funds that are to be repaid. Grant funds that must be returned are considered a Federal grant overpayment. The student can either repay the amount in full or make satisfactory arrangements with the University or the Department of Education to repay the amount due. These arrangements must be completed within 45 days of the date the University notifies the student of the overpayment status or risk losing eligibility for further federal financial assistance.

Return of Non-Title IV Funds

The portion of state, University, and other assistance that must be returned will be calculated based on the particular program’s return policy.

The student will be billed for any amount due to the University resulting from the return of Title IV and Non-Title IV funds.

* The total number of days in the semester includes weekends, but does not include any scheduled breaks of more than five days.
Appendix B: Standards of Progress

Satisfactory Progress Policy


This policy defines the minimum requirements for financial aid eligibility at MTU. Note that other types of financial aid (e.g., scholarships) may have more stringent requirements.

Students who do not meet the GPA requirements after any semester are not considered to be making satisfactory progress, and the affected financial aid for subsequent semesters will be canceled with the following exception: students who do not meet the GPA requirement after their first semester at MTU will be placed on financial aid probation and will remain eligible for financial aid for one semester. Students not meeting the schedule of credits earned after spring semester are not considered to be making satisfactory progress. Both GPA and credits earned requirements must be met for aid to be reinstated.

Requirement 1. Minimum Grade Point Average

Every student must maintain, at the end of each semester, a cumulative grade point average of at least

- 1.70 as a freshman (0–29 credits)
- 1.80 as a sophomore (30–59 credits)
- 2.00 as a junior (60–89 credits)
- 2.00 as a senior (90 or more credits)
- 2.00 as a postgraduate student
- 3.00 as a graduate student (MS, PhD)

Requirement 2. Minimum Credits Earned

Every student must adhere to the following schedule of credits earned, even if the academic major is changed. Audits (U or V) do not count toward credits earned. Transfer students, see below for additional information.

<table>
<thead>
<tr>
<th>Credits Earned at MTU</th>
<th>Full-Time Semesters at MTU</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Undergraduate Student</td>
</tr>
<tr>
<td>1</td>
<td>9</td>
</tr>
<tr>
<td>1.5*</td>
<td>13</td>
</tr>
<tr>
<td>2</td>
<td>18</td>
</tr>
<tr>
<td>3</td>
<td>28</td>
</tr>
<tr>
<td>4</td>
<td>38</td>
</tr>
<tr>
<td>5</td>
<td>49</td>
</tr>
<tr>
<td>6</td>
<td>60</td>
</tr>
<tr>
<td>7</td>
<td>71</td>
</tr>
<tr>
<td>8</td>
<td>82</td>
</tr>
<tr>
<td>9</td>
<td>94</td>
</tr>
<tr>
<td>10</td>
<td>106</td>
</tr>
<tr>
<td>11</td>
<td>118</td>
</tr>
<tr>
<td>12</td>
<td>130</td>
</tr>
<tr>
<td>More than 12</td>
<td>no aid</td>
</tr>
<tr>
<td>13</td>
<td>—</td>
</tr>
<tr>
<td>14</td>
<td>—</td>
</tr>
<tr>
<td>More than 14</td>
<td>—</td>
</tr>
</tbody>
</table>

Eligibility Defined

All students, regardless of whether they are receiving aid, have a limited number of semesters for which they are eligible for such aid. For example, undergraduates who have attended MTU for 8 full-time semesters may be eligible for another 4 semesters of aid, regardless of whether or not they have received aid in the past. The record of full-time semesters increases by one for every semester an undergraduate student is enrolled for 12 or more credits at the end of the official add period. If an undergraduate student is enrolled for 6–11 credits, the full-time semesters increase by one half. Full-time semesters will not increase during the semesters undergraduates students carry fewer than 6 credits.

An MS and PhD students' record of full-time semesters increases by one each semester in which they are enrolled for 6 or more credits at the end of the fifth class day. If an MS or PhD student is enrolled for 3–5 credits, the full-time semesters increase by one half.

In all other cases, full-time semesters are not increased.

Associate Degree Students—The undergraduate schedule of credits earned applies to students in associate degree programs. If the full-time semesters exceed 6, the student is not considered to be making satisfactory progress. Appeals based on the fact that some credits earned at MTU were used for a previous degree should be presented to the Financial Aid Office.

Students with Transfer Credit—The appropriate schedule of credits earned applies to students with transfer credit, with one additional step. The total number of credits transferred to MTU is divided by 15.5 to calculate full-time transfer semesters. That number is then subtracted from the total number of full-time semesters of eligibility at MTU to determine the number of semesters of eligibility remaining. If the combination of full-time semesters at MTU plus the full-time semesters calculated from transfer credit exceed the maximum allowed (12), the student is not considered to be meeting satisfactory progress requirements for financial aid. Example: A student who is transferring 62 semester credits to MTU would have 4 full-time transfer semesters (62 credits/15.5=4). The student in this example would have 8 full-time semesters of eligibility remaining (12 semesters maximum -4 calculated transfer semesters=8 semesters of remaining eligibility).

Postgraduate Students—Undergraduate students who have received their first bachelor's degree from another institution are considered to be making unsatisfactory progress when their full-time MTU semesters exceed 6. MTU undergraduates seeking a second bachelor's degree must follow the schedule of credit earned for undergraduate students.

Graduate Students—Credits earned include progress grades (P). GPA is calculated using all courses that appear on the graduate transcript.

Appeals and Reinstatements

Because financial aid dollars are applied to the first billing each semester, and the progress status is not determined until semester-end grades are processed, necessary adjustments will appear on a subsequent billing of the semester following a change of progress status.

If completion of temporary grades (I or X) or other transcript changes (e.g., grade changes) warrant reinstatement, the student should notify the Financial Aid Office by the end of the semester following unsatisfactory progress.

Students not meeting the satisfactory progress requirements because of mitigating or extenuating circumstances may request reinstatement of financial aid by a letter of appeal. Appeals should be submitted to the Financial Aid Office early in the first week of the semester following unsatisfactory progress. Full-time semesters may be adjusted, when appropriate, if a student's written appeal is approved, thus allowing continued eligibility.
NCAA Eligibility Requirements
The National Collegiate Athletic Association (NCAA) requires that student athletes be in good academic standing and maintain satisfactory academic progress toward a baccalaureate degree to remain eligible to represent an institution in intercollegiate athletics competition. The following table lists the total number of credits that must be completed and the minimum cumulative GPA that must be attained by a student at Michigan Technological University by the end of each academic year to meet NCAA eligibility requirements.

<table>
<thead>
<tr>
<th>Year Completed</th>
<th>Credits*</th>
<th>Cumulative GPA†</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st academic year</td>
<td>24</td>
<td>1.80</td>
</tr>
<tr>
<td>2nd academic year</td>
<td>48</td>
<td>2.00</td>
</tr>
<tr>
<td>3rd academic year</td>
<td>72</td>
<td>2.00</td>
</tr>
<tr>
<td>4th academic year</td>
<td>96</td>
<td>2.00</td>
</tr>
</tbody>
</table>

Students not meeting the satisfactory progress requirements because of mitigating or extenuating circumstances may request reinstatement by writing a letter of appeal to the Athletic Eligibility Committee, in care of the Registrar’s Office, within one week of notification of loss of eligibility.

* Credits that can be used for the completion of a bachelor’s degree.
† All courses taken at MTU.

Veterans’ Standards of Progress
The veterans’ standards of progress are the same as for all other university students as listed under “Academic Probation” and “Academic Dismissal.”

1. All students receiving veterans benefits must maintain a cumulative grade point average of 2.00. Failure to maintain that GPA will result in the student being placed on probation. A student will be allowed two terms, including the summer session, to raise the cumulative GPA to that required for graduation to come off probation. If the student fails to come off probation, the U.S. Department of Veterans Affairs (USDVA) will be notified in writing. Requests for reinstatement of VA benefits will be made only after a veteran has been removed from probation and has attained a cumulative GPA of 2.00 (on a 4.00 scale).
2. Student veterans not registered by the fifth day of instruction will be terminated from benefits.
3. All student veterans receiving benefits must schedule a minimum of 12 credits of their major core requirements to receive full benefits. Graduate students can only be certified for courses required by degree and must maintain a cumulative GPA of 3.00.
4. Repeated courses (F) are authorized for student veterans receiving benefits only if the course being repeated is a major, minor, or core requirement. Repeating a non-failing grade is not considered VA certifiable.
5. Two-year technology courses are not authorized for certification for student veterans enrolled in a four-year program.
6. All accepted applicants who are requesting veterans’ benefits will be given credit for previous training, where appropriate. The total length of time will be reduced proportionately toward completion of degree requirements. All students receiving veterans’ benefits must submit transcripts and other documents showing credit for previous training to the Admissions Office by the end of the first term of enrollment. Failure to do so will result in no further certification for veterans’ benefits until those transcripts have been provided.
Appendix C: Scholarships and Loans

Scholarships for First-Year Students

New Students

May be available as of August 2000

Jerry and Pat Aho Scholarship (renewable)
John E. Ahola Memorial Scholarship (renewable)
Alpha Society Scholarship
Reino E. Alanen Endowed Scholarship
Robert M. and Virginia Morse Anderson Scholarship (renewable)
Apostolic Lutheran Scholarship
George Hill Banks Memorial Scholarship
Beaverton Scholarship
Leann Becia Family/AFSME Scholarship
Besser Foundation Scholarship
John Biffl Memorial Endowed Scholarship (renewable)
Patrick Campioni Family Scholarship (renewable)
Colin Campbell Endowed Scholarship (renewable)
C-L-K Endowed Scholarship (renewable)
Joyce M. Burchenal Memorial Scholarship (renewable)
Woodrow and Margaret Grabel Bugge Scholarship (renewable)
Joyce M. Burchenal Memorial Scholarship (renewable)
C.L.K. Endowed Scholarship (renewable)
William D. Hartley Memorial Scholarship (renewable)
Dr. Michael J. Harris, MD Scholarship (renewable)
Ralph T. Hanna Jr. Memorial Scholarship (renewable)
Jerry and Pat Aho Scholarship (renewable)
May be available as of August 2000

New Students

Scholarships for First-Year Students

Appendix C:

Class Scholarships—from the

Patrick Campioni Family Scholarship (renewable)
Colin Campbell Endowed Scholarship (renewable)
C-L-K Endowed Scholarship (renewable)
Joyce M. Burchenal Memorial Scholarship (renewable)
Woodrow and Margaret Grabel Bugge Scholarship (renewable)
Joyce M. Burchenal Memorial Scholarship (renewable)
C.L.K. Endowed Scholarship (renewable)
William D. Hartley Memorial Scholarship (renewable)
Dr. Michael J. Harris, MD Scholarship (renewable)
Ralph T. Hanna Jr. Memorial Scholarship (renewable)
Jerry and Pat Aho Scholarship (renewable)
May be available as of August 2000

New Students

Scholarships for First-Year Students

Appendix C:
Scholarships for Undergraduate Students

**ALREADY ENROLLED**

**May be available as of August 2000**

- Robert L. Adams Memorial Scholarship
- Alcoa Foundation Scholarship
- John E. Ahola Memorial Scholarship (renewable)
- Alpha Society Scholarship
- Robert M. and Virginia Mercer Anderson Scholarship (renewable)
- Walter T. Anderson Electrical Engineering Scholarship
- Walter T. Anderson Technology Scholarship
- Apostolic Lutheran Scholarship
- Loyal C. Bacon Geophysical Scholarship
- George Hill Banks Memorial Scholarship
- Barr Engineering Company Scholarship
- Leann Beca Family/AFSCME Scholarship
- George D. Bellows Scholarship
- Besser Foundation Scholarship
- John Biffi Memorial Endowed Scholarship
- Dr. James A. Black Scholarship
- John W. Black Scholarship
- Marc R. Blackford Memorial Award in Physics
- Wilfred S. Bobier Jr. Endowed Scholarship
- Katherine M. Bosch Memorial Scholarship
- Professor Gilbert W. Boyd Memorial Scholarship
- Hugh J. Byrd Memorial Scholarship
- Patricia Ann Cabaniss Memorial Scholarship
- Colin Campbell Endowed Scholarship (renewable)
- Patrick Camponi Family Scholarship
- Campus Campaign Scholarship
- Vincent J. Capobianco Scholarship
- William and Marie Carls Foundation Scholarship
- Dr. C. M. Carson Endowed Memorial Scholarship
- Jerry Caspary Memorial Scholarship
- Caterpillar Employee Endowed Scholarship
- Caterpillar Foundation Scholarship
- Century II Campaign Scholarship
- Chamberlin Scholarship
- Richard Chandler Economics Scholarship
- Margaret H. Chapman Memorial Scholarship
- Viola L. Chase Memorial Scholarship
- Frank J. Chernosky Memorial Scholarship
- Chrysler Corporation Scholarship
- Chrysler Corporation Minority Scholarship
- Civil Engineering Endowed Scholarship
- Cleveland-Cliffs Iron Company Scholarship
- Harry R. Cohodas Memorial Scholarship
- Lloyd W. Coombe Endowed Memorial Scholarship
- Copper Country Endowed Scholarship
- Frederick William Gram Endowed Scholarship
- B. Mer W. Cress Memorial Scholarship
- Joseph D. Ories Memorial Scholarship
- Lorin Mackenzie and Wanda L. Jarnow Endowed Scholarship (renewable)
- Lloyd J. Dalquist Memorial Scholarship
- Ron and Connie Daman Senior Hardship Fund
- DeBower Foundation Scholarship
- Deere and Company Mechanical Engineering Scholarship
- Deere and Company Metallurgy Scholarship
- Deere and Company Minority Scholarship
- Delta Upsilon Fraternity Alumni Annual Scholarship
- Charles DeWitt Foundation Scholarship
- Gayton Alexander Doremi scholarship
- Douglass Houghton Chapter of MSPE Scholarship
- Dow Chemical Company Scholarship
- Dow Chemical Company Minority Scholarship
- Dr. Corbin T. Eddy Endowed Scholarship
- Mikeal Englerth Brotherhood Award

**NEW STUDENTS**

**May be available as of August 2000**

- Besser Foundation Scholarship
- Wilfred S. Bobier Jr. Endowed Scholarship (renewable)
- Lloyd W. Coombe Endowed Memorial Scholarship
- Iron Range Alumni Scholarship
- Louis A. Keary II Endowed Scholarship Fund (renewable)
- Lowe-Haataja Memorial Scholarship
- Michigan Junior and Community College Scholarship
- Michigan Tech Vets Club John R. Slining Memorial Scholarship
- Minority Academic Scholarship and Minority Grant
- David H. Morgan Memorial Community College Scholarship

**Scholarships for Transfer Students**

**NEW STUDENTS**

**May be available as of August 2000**

- Ambassador Scholarship
- Michigan Tech Canadian Foundation (McAllister) Scholarship (for new and currently enrolled Canadian students)
- Richard S. Stephenson Memorial (renewable)
- (for Canadian students)
Ensign-Bickford Scholarship
Dennis Euers Endowed Wisconsin Football Scholarship
Darlene and Dennis Euers Endowed Woman Athletes Scholarship
Harry and Carolyn Fauth Memorial Scholarship
Finn and Associates Surveying Scholarship
Mr. and Mrs. R. C. Ferguson Memorial Scholarship
First of America Bank-Copper Country Scholarship
James Fisher Scholarship
Robert and Marjorie Remington Endowed Scholarship (renewable)
Stephan Bryan Rofr Memorial Annual Scholarship Fund (renewable)
Football Alumni Scholarship
Ford Cars Scholarship (renewable)
Ford Cars Minority/Women Scholarship (renewable)
Forestry Endowed Scholarship
Ruth Freshour Memorial Scholarship
Brad C. Galitz Memorial Scholarship (renewable)
General Motors Corporation Scholarship
Dr. Frederick C. and Diane Guenther Endowed Scholarship (renewable)
Robert Ragen Memorial Scholarship
William A. Haglind Endowed Scholarship (renewable)
John F. and Mae M. Hakala Scholarship (renewable)
Ralph T. Hanna Jr. Memorial Scholarship (renewable)
Edward K. Hamar Endowed Basketball Scholarship
H. Kenneth Hamar Memorial Basketball Scholarship
Dr. Clyde T. Hardwick Memorial Scholarship
Dr. Michael J. Harris, MD Scholarship (renewable)
Frank M. Harwood Memorial Scholarship
William Hauser Memorial Athletic Scholarship
Sheldon G. Hayes Foundation Scholarship
Frederick L. Heinrich Scholarship
Lou Elyin and Ronald P. Helman Endowed Scholarship
Robert J. Hendrick's '24 Scholarship (renewable)
Edward C. Henricksen Memorial Scholarship
R. C. Herrmann Accounting Scholarship
Gene Hesterberg Forestry Scholarship
John C. Higgins Endowed Scholarship (renewable)
Jack Hollman Scholarship
Hoyt B. Hollister Scholarship
Houghton National Bank Endowed Scholarship
Robert D. Horner Scholarship
Ralph E. Huhtula Memorial Scholarship
Robert L. Hull Memorial Scholarship
Huskies Club Achievement Award
Husky Tai Kwon Do Club Scholarship
Harvey, Robert, and Ruth Hyde Memorial Scholarship
Laimo G. and Jennie R. Immenen Endowed Scholarship
India Student Endowed Scholarship
Inter-Residence Hall Scholarship
William G. and Gloria J. Jackson Endowed Scholarship (renewable)
Lawrence R. Jacobson Endowed Memorial Scholarship
Kathy Jean Jensen Endowed Scholarship
Jacqueline Jobet Memorial Scholarship
Cookie Johnson Endowed Scholarship
Dorothy Johnson Accounting Scholarship
Louis A. Keary II Endowed Scholarship Fund (renewable)
Scott R. Kieser Football Scholarship
Richard R. Kimmel Memorial Endowed Scholarship (renewable)
Robert F. Knight Memorial Scholarship
Charles Knobloch Mathematics Scholarship
Bernard Louis Kramer Memorial Endowed Scholarship (renewable)
Greg Krieger Memorial Endowed Scholarship
Ronald F. Krump Endowed Scholarship (renewable)
Walter Kyes Memorial Endowed Scholarship (renewable)
Ladish Company Foundation Scholarship
Lakehead Pipe Line Company, Inc., Scholarship
William H. Lange Endowed Scholarship (renewable)
Frank J. Larson Endowed Memorial Scholarship
Charles Locke Memorial Scholarship
Kelly Long Endowed Memorial Scholarship
William A. Longacre Sr. Memorial Scholarship (renewable)
Harold W. Lord Memorial Scholarship
M. J. Electric, Inc. Scholarship
John Maclnnes Memorial Scholarship
John Maclnnes Pep Band Award
N. S. Mackie Scholarship
John G. Magoffin Memorial Scholarship
Marquette Range Engineers Club Scholarship
A. A. Matthews Endowed Scholarship
Amie L. Mathy Scholarship
Charles J. Mathy Sr. Endowed Scholarship (renewable)
Jane and Fred Mayer Memorial Scholarship
Joseph H. Meagher Memorial Scholarship
Medical Alumni Endowed Scholarship
Dean Harold Meese Endowed Scholarship
Carl Merritt Endowed Scholarship
Richard C. Mertz Memorial Scholarship
Metalurgical Engineering Scholarship
Richard C. Meyers Memorial Scholarship
Esther Anne Michels Scholarship (renewable)
Michigan Tech Canadian Foundation (McAllister) Scholarship
Michigan Tech Fund Donors Scholarship
Michigan Tech Vets Club John R. Slings Memorial Scholarship
MTU Employees' Sons and Daughters Scholarship
MTU Leadership Scholarship
Gordon Milbourne Scholarship
3M Company Endowed Scholarship
3M Company Minority Scholarship
3M Company Scholarship
Minority Academic Scholarship and Academic Grant
Frank F. Monasa Endowed Memorial Scholarship
Moore & Bruggink, Inc. Endowed Scholarship (renewable)
Thomas C. Moore Memorial Scholarship
Charles and Patricia Nelson Forestry Scholarship
Kenneth Nelson Endowed Scholarship
John C. Noblet Memorial Scholarship
U. J. Noblet Memorial Scholarship (renewable)
Robert Logan Papworth Endowed Scholarship (renewable)
Timothy Patrick Nolan Endowed Memorial Scholarship (renewable)
Dr. Stephan Nordeng Scholarship
Robert G. Olson Memorial Scholarship
Ernest Orchard Endowed Scholarship
Fay L. Partio Endowed Scholarship
Dr. Robert M. Peterson Memorial Scholarship
Phua Sin En Memorial Scholarship
James Pierpoint Memorial Scholarship
Wilfrid C. & Ida R. Polkinghorne Endowed Scholarship (renewable)
John R. and Marae B. Ross Endowed Scholarship
Norman R. and Ruth M. Pratt Scholarship
Dorothy J. Preston Scholarship
Charles D. Putnam Endowed Scholarship (renewable)
Carle Eskerea Randall Memorial Scholarship
Jack Rea Endowed Scholarship (renewable)
Thomas B. Rees Scholarship
Eino Reini Scholarship (renewable)
Kenwal and Ann Reini Scholarship (renewable)
H. Walter and E. Joyce Rembold Permanently Endowed Scholarship (renewable)
Rice Memorial Scholarship
J. Murray Riddell Memorial Scholarship
George B. Robbe Endowed Memorial Scholarship
James S. Robbins Endowed Scholarship
K. Murray Scotch Memorial Scholarship
Rowe Inc. Scholarship (renewable)
Ted Rosza '36 Endowed Scholarship
L. C. and Rose M. Sagemuller Memorial Scholarship
Schlumberger Collegiate Award
J. and J. Scholten Recovery Scholarship
Donald W. Seaton Memorial Scholarship
Lloyd Seestedt Memorial Scholarship (renewable)
Rudy and Judy Shunt Memorial Scholarship (renewable)
Arthur Siewiert Endowed Scholarship
Julia and Milo Stagg Endowed Scholarship (renewable)
Norman Sloan Memorial Scholarship
Smith, Hinckman, & Gryllis Endowed Scholarship
Charles D. Smith Endowed Football Scholarship
Loan Funds

- Alpha Phi Omega Loan Fund
- American Institute of Plant Engineers Loan Fund
- Charles Home Baxter ’02 Memorial Loan Fund
- Frank P. Botsford ’00 Memorial Loan Fund
- Robert P. Brebner Memorial Loan Fund
- R. Bruce Carlson Memorial Loan Fund
- L. Jon Caspary Memorial Loan Fund
- Class of ’45 Loan Fund
- Edwin J. Collins ’03 Memorial Loan Fund
- Ray E. and Eleanor K. Cross Loan Program
- Walter W. J. Groze ’89 Memorial Loan Fund
- Cair M. Donovan Memorial Loan Fund
- Rudolph Ericson Loan Fund
- Rev. Feldscher Memorial Loan Fund
- Fordyce Loan Fund
- Robert L. Griffin Memorial Loan Fund
- Gogebic Range Engineers’ Club Loan Fund
- Homer A. Guck Memorial Loan Fund
- George M. Gulash Memorial Loan Fund
- Jacob C. and Nate Haas Loan Fund
- Dr. Han Chi Yeh Memorial Loan Fund
- Carleton Hascall ’11 Memorial Loan Fund
- John Sherman Hascall ’39 Memorial Loan Fund
- Sheila M. Heaton Memorial Loan Fund
- Norman E. Huhta Memorial Loan Fund
- International Student Loan Fund
- International Student Emergency Loan Fund
- Martin A. Johnson Memorial Loan Fund
- Frank Kerekes Memorial Loan Fund
- Paul M. Kidwell Memorial Loan Fund
- Lode Loan Fund
- John Munro Longyear ’12 Student Loan Fund
- Jonelle L. Marks Memorial Loan Fund
- Jon S. Mayer Memorial Loan Fund
- Daughters of the American Revolution of Michigan Loan Fund
- Mining Engineering Class of 1964 Loan Fund
- Miscellaneous Donors Loan Fund
- Robert G. Olson Student Loan Fund
- George A. Osborn Loan Fund
- Thomas V. Pakula Memorial Loan Fund
- Mabel Roberts Memorial Loan Fund
- Dan Royal Memorial Loan Fund
- George P. Schubert ’05 Memorial Loan Fund
- James G. Siddons Memorial Loan Fund
- Upper Peninsula Roadbuilders Memorial Loan Fund
- Melvin C. Van Lewen Memorial Loan Fund
- David A. Wallace Memorial Loan Fund
- H. J. Winkler, M.D. Student Loan Fund
- Wisconsin-Michigan Timber Producers Association Student Loan Fund
- Charles E. Wright Loan Fund
- Ben Zino Memorial Loan Fund
- Lena G. Zino Memorial Loan Fund
Appendix D: Emeriti Faculty

Agin, Michael L.; Professor Emeritus of Science Education; PhD, Wisconsin
Alexander, Kenneth O.; Professor Emeritus of Economics, Business and
Engineering Administration; PhD, MIT
Allen, Stuart C.; Associate Professor Emeritus of Mechanical Engineering; MA,
New York
Allison, John A. C.; Associate Professor Emeritus of Chemistry; PhD, Cambridge
(England)
Anderson, Howard B.; Professor Emeritus of Mathematics; MA, Michigan
Anderson, Jean A.; Associate Professor Emeritus of Mechanical Engineering; MS,
Wisconsin-Stout
Anderson, Walter T.; Director Emeritus, School of Technology; Professor Emeritus
of Electrical Engineering; MS, Michigan Tech
Bacon, Loyal O.; Professor Emeritus of Geophysics; MS, Pennsylvania State
Bahman, George E.; Professor Emeritus of Mathematics; MS, Michigan
Baldwin, Keith M.; Associate Professor Emeritus of Physics; MS, Maine
Berry, Myron G.; Professor Emeritus of Chemistry; PhD, Syracuse
Boutilier, Phyllis O.; Associate Professor Emeritus of Mathematics; MS,
Michigan Tech
Boyes, James E.; Professor Emeritus of Business and Engineering Administration;
PhD, Purdue
Brown, Robert T.; Professor Emeritus of Botany; PhD, Wisconsin
Butler, G. Robert; Professor Emeritus of Business and Engineering Administration;
MBA, Chicago
Chang, Edward C., PE; Professor Emeritus of Mechanical Engineering; PhD,
Kansas State
Chimino, David F.; Presidential Professor Emeritus of Physics; MS, Michigan
Clark, John R.; Professor Emeritus of Electrical Engineering; PhD, Ohio State
Cox, Verdie T.; Professor Emeritus of Physical Education; MS, Illinois
Crowther, C. Richard; Professor Emeritus of Forestry; PhD, Michigan
Darlymple, Jean M.; Associate Professor Emeritus of Engineering Mechanics;
PhD, Michigan State
Dawson, Donald E.; Professor Emeritus of Engineering Mechanics and Mathematics;
PhD, Pennsylvania
Dawson, Gladys Q.; Associate Professor Emerita of Chemistry; PhD, Illinois
El Khadem, Hassan S.; Professor Emeritus of Chemistry; PhD, Imperial College
(England); DSc, Alexandria (Egypt); DSc, London (England)
ElRite, Richard E.; Associate Professor Emeritus of Physical Education; MS,
Moorhead State
Frantti, Gordon E.; Professor Emeritus of Geology; MS, Michigan Tech
Frebyberger, Wilfred L.; Professor Emeritus of Metallurgical Engineering; PhD, MIT
Funkenbusch, W. William; Professor Emeritus of Mathematics; MS, Oregon State
Gale, Calvin W.; Dean Emeritus of Special Academic Programs; Professor Emeritus
of Education; PhD, Wisconsin
Gibson, Aubrey W., PE; Associate Professor Emeritus of Mechanical Engineering;
MS, Kansas
Greger, Rudolf E.; Professor Emeritus of Mining Engineering; PhD, DE School of
Mines, West Germany
Haas, Wilbur M., PE; Professor Emeritus of Civil and Environmental Engineering;
PhD, Wisconsin
Hakola, David T.; Professor Emeritus of Social Sciences; MA, Case Western Reserve
Häntßenhoff, C. Edwin; Distinguished Lecturer Emeritus of Civil and Environmental
Engineering; BS, Lehigh
Hawthorne, June C.; Assistant Professor Emerita, J. Robert VanPelt Library;
ABLS, Michigan
Hockel, Richard W.; Professor Emeritus of Metallurgical and Materials Engineering;
PhD, Carnegie Mellon
Hein, Charles E.; Assistant Professor Emeritus of Surveying; MS, Michigan Tech
Hellwell, Angus; Professor Emeritus of Metallurgical and Materials Engineering;
PhD, Oxford University, England
Hellen, Gordon A.; Professor Emeritus of Mechanical Engineering; MS,
Michigan Tech
Hendrickson, Alfred A.; Professor Emeritus of Metallurgical Engineering; PhD,
Northwestern
Hennessey, Richard L., PE; Associate Professor Emeritus of Civil Engineering; MS,
Iowa State
Hesterberg, Gene A., RF; Professor Emeritus of Forestry; PhD, Michigan
Hil, A. Spencer; Professor Emeritus of Social Sciences; PhD, Wisconsin
Hinzmann, Paul R.; Associate Professor Emeritus of Physics; MA, Michigan
Holland, Jack C.; Professor Emeritus of Biological Sciences; PhD, Michigan Tech
Hung, Eugene Y., PE; Professor Emeritus of Transportation Engineering; DSc,
Michigan
Hunzeker, Hubert L.; Professor Emeritus of Mathematics; PhD, Michigan
Janke, R. Arthur; Associate Professor Emeritus of Biological Sciences; PhD,
Colorado
Johnson, Allan M.; Associate Professor Emeritus of Mining Engineering; PhD,
Michigan Tech
Johnson, K. Ross; Professor Emeritus of Electrical Engineering; PhD,
Michigan State
Johnson, Vernon W., RF; Professor Emeritus of Forestry; MS, Syracuse
Julien, Larry M.; Associate Professor Emeritus of Chemistry; PhD,
University of Iowa
Kalikoski, Jorma O.; Professor Emeritus of Geology; PhD, Princeton
Kauppila, Raymond W.; Professor Emeritus of Mechanical Engineering; PhD,
Michigan
Kearly, Theodore H.; Professor Emeritus of Physical Education; MA,
Michigan State
Keeling Jr., Rolland O.; Professor Emeritus of Physics; PhD, Pennsylvania State
Kenny, David H.; Associate Professor Emeritus of Chemistry; PhD, Michigan
Kirckish, Joseph B.; Professor Emeritus of Humanities; PhD, Michigan
Koopet, Edward J.; Vice President Emeritus of Operations and Finance; Associate
Professor Emeritus of Metallurgical Engineering; MS, Michigan Tech
Koski, Paul I.; Associate Professor Emeritus of Mechanical Engineering; MA,
Michigan
Kraft, Kenneth J.; Associate Professor Emeritus of Forestry and Wood Products
and Biological Sciences; PhD, Minnesota
Krentisky, Michael V.; Library Director Emeritus; MA, Southern Methodist
Krueger, Gordon P.; Dean Emeritus School of Engineering; Professor Emeritus of
Civil and Wood Engineering; PhD, Wisconsin
Kuister, John H.; Associate Professor Emeritus of Mathematical Sciences; MS,
Michigan Tech
Lind, Merrill S.; Professor Emeritus of Electrical Engineering; MS, Minnesota
Love, George J.; Associate Professor Emeritus of English; MA, Columbia
Lower, George W.; Professor Emeritus of Metallurgical Engineering; PhD, Lehigh
Lucier, William G.; Vice President Emeritus of Administrative and Student
Services; Associate Professor Emeritus of Physical Education; MS, Michigan
Luehrs, Dean C.; Professor Emeritus of Chemical Engineering; PhD,
University of Kansas
Mandeville, Charles E.; Professor Emeritus of Physics; PhD, Rice
Marshall Jr., Samuel A.; Professor Emeritus of Physics; PhD, Catholic University
of America
McMillin, Kenneth M.; Professor Emeritus of Mathematics; PhD, Cincinnati
Meese, Harold; Dean Emeritus of Students; MS, Ohio State
Meeter, James W.; Professor Emeritus of Forestry; M.F., Michigan
Miller, Roswell K., RF, FS; Associate Professor Emeritus of Forestry and Wood
Products; PhD, Michigan
Ortner, Gene M.; Professor Emeritus of Mathematics; PhD, Pittsburgh
Potnis V. R.; Professor Emeritus of Physics; PhD, Agra University, India

Powers, William J.; Professor Emeritus of Literature; PhD, University of Illinois

Peach, Milton Q.; Professor Emeritus of Engineering Mechanics; Sc.D., Carnegie Institute of Technology

Romig, Joseph A.; Professor Emeritus of Business; LL.M., Wisconsin

Ruehr, Otto G.; Professor Emeritus of Mathematics; PhD, Michigan

Ruostala, Albert P.; Professor Emeritus of Geological Engineering and Sciences; PhD, Illinois

Sachs, Harley L.; Associate Professor Emeritus of English; MAT, Indiana

Sajdak, Robert L.; Associate Professor Emeritus of Forestry; MS, Minnesota

Sandel, Vernon R.; Associate Professor Emeritus of Chemistry; PhD, Northwestern

Shandley, Paul D.; Associate Professor Emeritus of Physics; MS, Rochester

Shetron, Stephen G.; Professor Emeritus of Forestry; PhD, Michigan

Smith, Derrel W.; Professor Emeritus of Metallurgical and Materials Engineering; PhD, Case Western Reserve

Smith, Raymond L.; President Emeritus; Professor Emeritus of Metallurgical Engineering; PhD, Pennsylvania; DSc, Western Michigan; LL.D. (Hon.), Northern Michigan

Snyder, Virgil W., PE; Professor Emeritus of Engineering Mechanics; PhD, Arizona

Spain, Robert J.; Associate Professor Emeritus of Mathematics; PhD, Michigan State

Spain, James D.; Professor Emeritus of Biochemistry; PhD, Stanford

Stebbins, Dean W.; Vice President Emeritus for Academic Affairs; PhD, Iowa State

Stebler, Robert C.; Professor Emeritus of Applied Technology; MA, California State University, Los Angeles

Stein, Dale F.; President Emeritus; PhD, Rensselaer Polytechnic Institute

Suryanarayana, Narasipur V.; Professor Emeritus of Mechanical Engineering; PhD, Michigan

Thayer, Duane M.; Professor Emeritus of Metallurgical Engineering; BS, Michigan Tech

Tidwell, Samuel B., CPA; Professor Emeritus, Business and Engineering Administration; MA, George Peabody College for Teachers

Vichich, Thomas E.; Professor Emeritus of Mathematics; MS, Michigan

Watwood, Vernon B.; Professor Emeritus of Civil Engineering; PhD, University of Washington, Seattle

Weaver, Arthur S.; Professor Emeritus of Engineering Mechanics; MS, Maine

Weingarten, Warren O.; Professor Emeritus of School of Technology; PhD, University of Illinois, Urbana-Champaign

Whitten, Bertwell K.; Professor Emeritus of Biological Sciences; PhD, Purdue

Williams, Edwin T.; Professor Emeritus of Chemistry and Chemical Engineering; PhD, Pennsylvania State

Work, Clyde E.; Professor Emeritus of Engineering Mechanics, PhD, Illinois.

Yerg, Donald G.; Professor Emeritus of Physics; PhD, Pennsylvania State
Appendix E:
Assessment, Leadership, Accreditation, Membership

Assessment

Michigan Technological University is committed to continuous improvement of its educational programs. An important part of our improvement effort is MTU's program for Assessment of Student Learning. In each department, our faculty set goals for student learning that go beyond the content of any single course. Examples include such things as “a unified and integrated understanding of their major field as a whole, skills for critical thinking and systematic analysis,” and “good oral and written communications skills.”

To measure students’ success in achieving these learning goals, we collect samples of student work, administer special exams, and conduct student interviews throughout the year. The purpose of this assessment is to identify opportunities for improvement of our curricula by measuring the success of students as a group. Thus, student identification is removed from all documents before they are evaluated. When assessment activities are based on work that is also part of a class, separate copies are used for assessment and grading.

The results of assessment activities are summarized each fall as a report and discussed by the faculty in each department to determine how the curriculum and teaching practices may be revised to improve student learning. The University administration reviews assessment activities and uses assessment findings to help make decisions about program growth.

Board of Control

(All terms expire December 31 of year indicated)

Kenneth E. Rowe, Calumet, Michigan 1993–2000
Martin G. Lagina, Traverse City, Michigan 1995–2002

* Term extended by Governor of Michigan

University Administrators

President, Curtis J. Tompkins

Provost and Sr VP for Academic and Student Affairs, Warren Kent Wray
  Vice Provost for Instruction, Stephen H. Bowen
  Vice Provost for Information Technology, James S. Cross
  Vice Provost/Dean for Student Affairs, Martha Y. Janners
  Vice Provost for Research/Dean, Graduate School, Sung M. Lee

Senior VP for Advancement and Marketing, John D. Sallars

VP of Governmental Relations; Sec'y, Board of Control, Dale R. Tahtinen

Treasurer/VP for Finance and Administration, William J. McGarry

Faculty Administration

College of Engineering
  Dean, Robert O. Warrington Jr.
  Associate Dean, Neil J. Hutzler
  Associate Dean, Mark R. Plichta

Department Chairs
  Chemical Engineering, Kirk H. Schulz
  Civil and Environmental Engineering, C. Robert Baillod
  Electrical and Computer Engineering, Timothy J. Schulz
  Engineering Fundamentals, Sheryl A. Sorby
  Geological Engineering and Sciences, Theodore J. Bornhorst
  Materials Science and Engineering, Calvin L. White
  Mechanical Engineering–Engineering Mechanics, William W. Predebon
  Mining Engineering, Neil J. Hutzler (interim)

College of Sciences and Arts
  Dean, Maximilian J. Seel

Department Chairs
  Aerospace Studies, John C. Casserino
  Army ROTC, George W. Wheelock
  Biological Sciences, John H. Adler
  Chemistry, Pushalatha P. N. Murthy (interim)
  Computer Science, Linda M. Ott
  Education, Beverly J. Baartmans (interim)
  Fine Arts, Milton L. Olsson
  Humanities, Robert R. Johnson
  Mathematical Sciences, Alphonse H. Baartmans
  Physical Education, Cheryl A. DePuydt
  Physics, J. Bruce Rafert
  Social Sciences, Terry S. Reynolds

School of Business and Economics
  Dean, R. Eugene Klippel
  Associate Dean, Terry D. Monson

School of Forestry and Wood Products
  Dean, Glenn D. Mroz (interim)

School of Technology
  Dean, Timothy H. Collins

J. R. Van Pelt Library
  Director, Phyllis H. Johnson
University Accreditation

Michigan Technological University is accredited by North Central Association of Colleges and School’s Commission on Institutions of Higher Education. Accreditation documentation may be reviewed in the Office of the Provost and Senior Vice President for Academic and Student Affairs.

North Central Association of Colleges and Schools, Commission on Institutions of Higher Education, 30 North LaSalle St, Suite 2400, Chicago, IL 60602-2504; 312-263-0456 and 800/621-7440 (telephone); 312-263-7462 (fax); Info@ncacche.org (e-mail).

In addition to the general accreditation, some programs have been accredited, approved, or recognized by their respective agencies.

College of Engineering

The Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology (ABET) accredits the following engineering programs:

- chemical engineering
- civil engineering
- electrical engineering
- engineering (interdisciplinary or special focus)
- environmental engineering
- geological engineering
- materials science and engineering
- mechanical engineering
- mineral process engineering
- mining engineering

School of Technology

The Technology Accreditation Commission of ABET accredits the following engineering technology programs:

- AAS in chemical engineering technology
- AAS in electrical engineering technology
- AAS in electromechanical engineering technology
- BS in engineering technology with concentrations in electrical engineering technology and mechanical engineering technology

The Related Accreditation Commission of ABET accredits the surveying program.

ABET address

Accreditation Board for Engineering and Technology, Inc., 111 Market Place, Suite 1050, Baltimore, MD 21202; 410-347-7700 (telephone), 410-625-2238 (fax).

The AAS in forest technology is recognized by the Society of American Foresters.

Society of American Foresters, 6400 Grosvenor Lane, Bethesda, MD 20814–2198; 301-897-8720 (telephone); 301-897-3690 (fax).

College of Sciences and Arts

The Department of Chemistry offers American Chemical Society certified degrees and interdisciplinary options.

Fourth-year instruction in the 3+1 clinical laboratory science option is carried out in hospitals accredited by the National Accrediting Agency for the Clinical Laboratory Sciences (NAACLS).

Michigan Board of Education approves the teacher certification programs.

School of Business and Economics

Students completing the accounting curriculum with appropriate course work may qualify to sit for the Uniform Certified Public Accountant exam.

School of Forestry

The Society of American Foresters accredits the forestry program.

Society of American Foresters, 6400 Grosvenor Lane, Bethesda, MD 20814–2198; 301-897-8720 (telephone); 301-897-3690 (fax).

Memberships

Michigan Technological University holds membership in the following organizations:

- American Association of State Colleges and Universities
- American Association of University Women
- American Council on Education
- American Society of Composers
- Broadcast of Music
- The College Board
- The Conference Board
- Council on Undergraduate Research
- Council on Competitiveness
- Institute of International Education
- Keweenaw Chamber of Commerce
- Keweenaw Industrial Council
- Merit Network
- MERRA
- National Alliance of Business
- National Association of College and University Attorneys
- National Association of College and University Business Officers
- National Association of State Universities and Land Grant Colleges
- National Student Exchange
- North Central Association of Colleges and Schools (NCA)
- Oak Ridge Associated Universities
- Operation Action UP
- President’s Council
- Science Coalition
- SESAC Inc.
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