2006 UNDERGRADUATE CATALOG
## 2006–07 Academic Calendar

### FALL SEMESTER 2006
- **August 27, Sunday - September 02, Saturday**: Orientation
- **August 30, Wednesday**: Fall Bills Due
- **September 04, Monday**: Labor Day
- **September 05, Tuesday**: Instruction Begins
- **September 08, Friday Noon**: K-Day recess begins
- **September 11, Monday**: Classes resume
- **September 29, Friday 3:00 PM**: Homecoming Recess begins
- **September 11, Monday**: Classes resume
- **September 29, Friday 3:00 PM**: Homecoming Recess begins
- **October 02, Monday**: Part of Term A ends
- **October 23, Monday**: Mid-Term grades available
- **October 30, Monday - November 12, Sunday**: Spring semester registration
- **November 17, Friday 10:00 PM**: Thanksgiving recess begins
- **November 27, Monday**: Classes resume
- **December 15, Friday**: Last day of regular classes
- **December 16, Saturday**: Mid-year commencement
- **December 18, Monday - December 22, Friday**: Final exam period
- **December 22, Friday**: Fall semester ends

### SPRING SEMESTER 2007
- **January 10, Wednesday**: Spring bills due
- **January 14, Sunday**: Orientation
- **January 15, Monday**: Instruction begins
- **January 15, Monday 12:00 pm**: Martin Luther King recess begins
- **January 16, Tuesday**: Classes resume
- **February 07, Wednesday 10:00 PM**: Winter Carnival recess begins
- **February 12, Monday**: Classes resume
- **March 02, Friday**: Part of Term A ends
- **March 05, Monday**: Mid-Term grades available
- **March 05, Monday**: Part of Term B - 2nd half begins
- **March 05, Monday**: Summer Session registration
- **March 09, Friday 10:00 PM**: Spring Break begins
- **March 19, Monday**: Classes resume
- **April 03, Tuesday - April 16, Monday**: Fall semester registration
- **April 27, Friday**: Last day of regular classes
- **April 30, Monday - May 04, Friday**: Final Exam period
- **May 04, Friday**: Spring semester ends
- **May 05, Saturday**: Spring Commencement

### SUMMER SEMESTER 2007
- **May 14, Monday**: Full session begins/Session A begins
- **May 28, Monday**: Memorial Day recess, 1 day only
- **June 28, Thursday**: Session A ends
- **June 29, Friday**: Session A exam period
- **July 02, Monday**: Session B begins
- **July 04, Wednesday**: Independence Day recess, 1 day only
- **August 16, Thursday**: Session B ends/Full Session ends
- **August 17, Friday**: Full Session, Session B exam period
Dear Students:

There are a lot of good things happening at Michigan Tech, and I'm glad you've chosen to be a part of it.

Academically, we've responded to students' educational needs by adding nearly 20 new degree programs to our schedule. Our dedication to active discovery based learning include our Enterprise Programs, Forest and Environmental Resource Management Programs, and Applied Portfolio Management Programs. A new Honors Program began in 2005 and a Technological Leadership Program will begin in fall 2006.

New masters and doctoral programs have been added as well, all with fidelity to our role as a technological university.

Our programs are designed by some of the best faculty in the world, and in excellent facilities.

I strongly encourage each of you to take a tour of campus and meet with faculty who are truly dedicated to student learning.

I truly hope you take advantage of our facilities, activities, and events to make the most of your Michigan Tech education.

I wish you well!

Michigan Technological University

Mission
We prepare students to create the future.

Vision
Michigan Tech will grow as a premier research university of international stature, delivering education, new knowledge, and innovation for the needs of our
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- School of Business and Economics
- School of Forest Resources and Environmental Science
- School of Technology

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- Army—Department of Military Science
- Biological Sciences
- Biomedical Engineering
- Chemical Engineering
- Chemistry
- Civil and Environmental Engineering
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- Electrical and Computer Engineering
- Engineering Fundamentals
- Fine Arts
- Geological and Mining Engineering and Sciences
- Humanities
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**Campus Map**
About Michigan Tech

Michigan Tech was founded in 1885 in response to the first mining boom in the US—the clamor for Michigan's copper, which preceded the California Gold Rush by several years.

At its outset, the college trained mining and metallurgical engineers. Today, the University offers certificates, minors, associate's, bachelor's, master's, or doctoral degrees in the arts and human sciences, business, computing, engineering, environmental studies, sciences, 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 worldwide 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 tenth-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.
## Campus Contacts

### Essential Student Services
- **Admissions (mtu4u@mtu.edu)**: 487-2335
- **Graduate Admissions**: 487-2327
- **Transfer Admissions**: 487-2335
- **Counseling Services**: 487-2538
- **Financial Aid Office**: 487-2319
- **Housing (Residential Services)**: 487-2682
- **International Programs and Services**: 487-2160
- **Student Records and Registration, Office of (OSRR)**: 487-2319

### Colleges, Schools, Departments
- **College of Engineering**: 487-2005
  - Biomedical Engineering: 487-2772
  - Chemical Engineering: 487-2772
  - Civil & Environmental Engineering: 487-2772
  - Electrical and Computer Engineering: 487-2550
  - Engineering Fundamentals: 487-3057
  - Geological & Mining Engineering & Sciences: 487-2531
  - Materials Science and Engineering: 487-2630
- **College of Sciences and Arts**: 487-2156
  - Air Force ROTC: 487-2652
  - Army ROTC: 487-2650
  - Biological Sciences: 487-2025
  - Chemistry: 487-2048
  - Computer Science: 487-2209
  - Education: 487-2460
  - Fine Arts: 487-2067
  - Humanities: 487-2540
  - Mathematical Sciences: 487-2068
  - Physics: 487-2086
  - Physical Education/Exercise Sciences: 487-2715
  - Social Sciences: 487-2113
- **Schools of**
  - Business and Economics: 487-2668
  - School of Forest Resources & Env Science: 487-2454
  - School of Technology: 487-2259

### University Offices
- **Affirmative Programs**: 487-3310
- **Athletic Department**: 487-3070
- **Bookstore, Manager**: 487-2410
- **Career Center, University**: 487-2313
- **Central Ticket Office**: 487-2073
- **Daniell Heights Apartments**: 487-2727
- **Dean of Students**: 487-2951
- **Degree Services**: 487-2395
- **Educational Opportunity**: 487-3539
- **Graduate School**: 487-2327
- **Health Insurance**: 487-3055
- **Health Services, University**: 487-1860
- **Identification Cards (Tech Express Office)**: 487-3308
- **Information Technology**: 487-0076
- **International Programs and Services**: 487-2160
- **Intramural Sports**: 487-2929
- **Library, Director**: 487-2500
  - **Circulation**: 487-2508
  - **Reference**: 487-2507
- **Mail Services**: 487-2348
- **Memorial Union, Director**: 487-2543
- **Museum, Seaman Mineral**: 487-2572
- **Ombudsperson**: 487-2043
- **President’s Office**: 487-2200
- **Provost’s Office**: 487-2440
- **Research**: 487-3043
- **Student Records and Registration**: 487-2319
- **Student Affairs**: 487-2212
- **Transcripts**: 487-2317
- **Vehicle Registration/Parking Permits**: 487-2319
- **Veterans’ Affairs**: 487-2319

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Toll free (for prospective students only): 1-888-MTU-1885  
E-mail: mtu4u@mtu.edu

### Switchboard
- **906-487-1885**

### Emergency
- **On campus, dial 123**
- **Off campus, call Public Safety 487-2216 or 911**

### Mailing Address
- **(Name or department)**  
  Michigan Technological University  
  1400 Townsend Drive  
  Houghton, MI 49931-1295
Degree Programs at MTU

- School of Business & Economics
- College of Engineering
- School of Forest Resources & Environmental Science
- School of Technology
- College of Sciences & Arts
- Interdisciplinary
- Certificate Programs

**School of Business & Economics**
Business Administration (BS) (MS)
- Accounting
- Finance
- Management
- Management Information Systems
- Marketing
- Operations & Systems Management
Economics (BS)
- Economics—Secondary Education
Economics (Minor)
Mineral Economics (MS)

**College of Engineering**
Engineering (BS)
- Manufacturing—Distance
- Mechanical Design—Distance
Enterprise (Minor)
Engineering (PhD)
Computational Science and Engineering (PhD)
Environmental Engineering (PhD)
Master of Engineering (MEng)

**Biomedical Engineering**
Biomedical Engineering (BS)
- Biomedical Engineering Enterprise
  *(Specific info available from department)*
Biomedical Engineering (PhD)

**Chemical Engineering**
Chemical Engineering (BS) (MS) (PhD)
Engineering Enterprise
Minerals Processing (Minor)
Polymer Science and Engineering (Minor)

**Civil & Environmental Engineering**
Civil Engineering (BS) (MS) (PhD)
- Engineering Enterprise
Municipal Engineering (Minor)
Environmental Engineering (BS) (MS)
- Engineering Enterprise
Environmental Engineering Science (MS)
Master of Engineering—Civil Engineering (MEng)
Master of Engineering—Environmental Engineering (MEng)

**Electrical & Computer Engineering**
Computer Engineering (BS)
- Computer Engineering Enterprise
Electrical Engineering (BS) (MS) (PhD)
- Engineering Enterprise
Photonics

**Engineering Fundamentals**

**Geological & Mining Engineering & Sciences**
Applied Geophysics (BS)
Applied Geophysics (Minor)
Geological Engineering (BS) (MS) (PhD)
- Engineering Enterprise
Geology (BS) (MS) (PhD)
Earth Science Secondary Education
Geophysics (MS)
Mining Engineering (MS) (PhD)
Geological Engineering (Minor)
Earth Sciences (Minor)
Mining (Minor)

**Materials Science & Engineering**
Materials Science & Engineering (BS) (MS) (PhD)
- Engineering Enterprise *(Specific info available from department)*
Electronic Materials (Minor)
Structural Materials (Minor)

**Mechanical Engineering-Engineering Mechanics**
Engineering Mechanics (MS)
Mechanical Engineering (BS) (MS)
- Engineering Enterprise
Manufacturing (Minor)
Product Design (Minor)
Mechanical Engineering-Engineering Mechanics (PhD)
Engineering—Manufacturing (Distance)
Engineering—Mechanical Design (Distance)

**School of Forest Resources & Environmental Science**
Applied Ecology (MS)
Applied Ecology & Environmental Sciences (BS)
Ecology (Minor)
Forest Ecology & Management (MS)
Forest Molecular Genetics & Biotechnology (MS) (PhD)

*FRES continued*
Forestry (BS) (MS)
Forest Science (PhD)
Master of Forestry (MF)
Plant Biotechnology (Minor)
Plant Sciences (Minor)
Remote Sensing (Minor)
Wildlife Ecology & Management (BS)

School of Technology
Computer Network & System Administration (BS)
Construction Management (BS)
Electrical Engineering Technology (BS)
Industrial Technology (BS)
Mechanical Engineering Technology (BS)
Surveying Engineering (BS)

College of Sciences & Arts
Biochemistry and Molecular Biology (BS)

Biological Sciences
Bioinformatics (BS)
Biological Sciences (BS) (MS) (PhD)
  Ecology
  Fish Biology
  General Biology
  Microbiology
  Molecular/Biochemistry
  Plant Sciences
  Pre-professional (Medicine, Dentistry, etc)
  Secondary Education
Biochemistry (Minor)
Biological Sciences (Minor)
Microbiology (Minor)
Clinical Laboratory Science (BS)
  3+1 Clinical Lab Science
  4+1 Clinical Lab Science
  3+1 Cytotechnology
  3+1 Histotechnology (Conc) SCL5
  4+1 Cytotechnology (Conc) SCL6
  4+1 Histotechnology (Conc) SCL7
  4+1 Secondary Education (Conc)

Chemistry
Cheminformatics (BS)
Chemistry (BS) (MS) (PhD)
  Biochemistry
  Chemical Physics
  Environmental
  Polymers
  Secondary Education
Pharmaceutical Chemistry (BS)
Chemistry (Minor)

Computer Science
Computer Science (BS) (MS) (PhD)
  Applications
  Computer Science
  Information Systems
  Secondary Education
  Software Engineering
Computer Systems Science (BS)
Software Engineering (BS)
Computer Science (Minor)

Education
Applied Science Education (MS)
Psychology (BS)
Psychology (Minor)

Secondary Education-Teacher Certification
  Biological Sciences
  Business Administration
  Chemistry
  Computer Science
  Earth Science
  Economics
  Liberal Arts/English
  Mathematics
  Physics
  Social Sciences
  Teacher Education
  Technology and Design

Secondary Education—Teacher Certification Minors
  (Secondary Education Majors only)
  Biological Sciences
  Chemistry
  Computer Science
  Earth Science
  Economics
  English
  Mathematics
  Physics
  Technology and Design

Exercise Science, Health and Physical Education
Exercise Science (BS)

Fine Arts
Audio Production and Technology (BS)
Sound Design (BA)
Theatre and Entertainment Technology (BA) (BS)
Art (Minor)
Music (Minor)
Technical Theater (Minor)
Theater Arts (Minor)
Humanities
Humanities (ASC)
Communication & Culture Studies (BA)
Communication in Contemporary Culture (Conc)
Communication in Human Interaction &
   Global Contexts (Conc)
Communication Media (Conc)
Liberal Arts (BA)
   English
   English Secondary Education
   Interdisciplinary
Rhetoric & Technical Communication (MS) (PhD)
Scientific & Technical Communication (BA) (BS)
Communication Studies (Minor)
Ethics and Philosophy (Minor)
French (Minor)
German (Minor)
International French (Minor)
International German (Minor)
International Spanish (Minor)
Journalism (Minor)
Spanish (Minor)

Mathematical Sciences
Mathematics (BS)
   Actuarial Science
   Applied/Computational
   Discrete Mathematics
   Education Preparation
   General Mathematics
   Secondary Education
   Statistics
Mathematical Sciences (MS) (PhD)
Mathematical Sciences (Minor)

Physical Education
Exercise Science (BS)

Physics
Applied Physics (BS)
Engineering Physics (PhD)
Physics (BS) (MS) (PhD)
   Secondary Education
Astrophysics (Minor)
Physics (Minor)

Air Force ROTC
Aerospace Studies (Minor)

Army ROTC
Military Arts and Science (Minor)

Social Sciences
Anthropology (BS)
Environmental Policy (MS)

Industrial Archaeology (MS)
Industrial Heritage & Archaeology (PhD)
Social Sciences (BS)
   Law and Society (BS)
   Secondary Education
Liberal Arts-History (BA)
American Studies (Minor)
Environmental Studies (Minor)
Historical Studies (Minor)
International Studies (Minor)
Social and Behavioral Studies (Minor)

Interdisciplinary
Atmospheric Sciences
Bioprocess Engineering (Minor)
Enterprise Teams
Ecology (Minor)
Plant Biotechnology (Minor)
Nanoscale Science and Engineering (Minor)
Plant Sciences (Minor)
Remote Sensing (Minor)

Certificate Programs
Actuarial Science
Advanced Modern Language—
   French
   German
   Spanish
Design Engineering—Distance
Industrial Forestry
International Business
Media
Mine Environmental Engineering
Modern Language—
   French
   German
   Spanish
Writing
Graduate Certificate in Sustainability
Academic Programs

The requirements for all degree programs, associate and baccalaureate, as well as the requirements for certificates and minors, for the 2006-07 academic year are linked below.

- **Associate Degree**
- **Baccalaureate Degrees**
- **Certificates**
- **Minors**

For the most accurate and up-to-date requirements, see your advisor or department. You may also select a degree audit that coincides with the academic year you enrolled at Michigan Tech by using the Undergraduate Degree Audit Search.

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.

**Associate Degree**

Michigan Tech has a two-year program in the College of Sciences and Arts (ASC). Those students who wish to combine an associate degree with a baccalaureate degree should see their academic advisors.

**College of Sciences and Arts (PDF)**

- Humanities—Associate Degree (SAH)
Michigan Tech has a variety of four-year degree programs in all fields. This section presents the requirements for a Bachelor of Science or Arts degree (BS or BA), listed alphabetically by college or school.

**School of Business and Economics**

**College of Engineering**

**School of Forest Resources and Environmental Science**

**College of Sciences and Arts**

**School of Technology**

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 with their academic advisors. Also see degree audit information and instructions.

## Baccalaureate Degrees

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<th>Management Information Systems (BBA5)</th>
<th>Marketing (BBAA)</th>
<th>Operations &amp; Systems Management (BBAC)</th>
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<td>Accounting (BBA2)</td>
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<tr>
<th>School of Forest Resources and Environmental Science</th>
<th>Wildlife Ecology &amp; Management (FWEM)</th>
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<td>Applied Ecology &amp; Environmental Sciences (FES)</td>
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<tr>
<td>Forestry (FFR)</td>
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</table>
**School of Technology**

- Computer Network & System Administration (TCSA)
- Construction Management—BS (TCMG)
- Electrical Engineering Technology—BS (TEET)
- Industrial Technology—BS (TINT)
- Mechanical Engineering Technology—BS (TMET)
- Surveying Engineering—BS (TSE)

**College of Sciences and Arts**

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<th>Program</th>
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<td>3+1 Cytotechnology (SCL4)</td>
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<td>3+1 Histotechnology (SCL5)</td>
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<td>Cheminformatics (SCHI)</td>
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<td>Chemistry—Secondary Education (SCH3)</td>
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<td>Communication in Human Interactions &amp; Global Contexts (SCC2)</td>
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<td>Communication Media (SCC3)</td>
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<td>Computer Science (SCS2)</td>
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<td>Computer Systems Science (SCSY)</td>
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<tr>
<td>Discrete Mathematics (SMA5)</td>
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<td>Ecology (SBL3)</td>
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<td>Education Preparation Mathematics (SMA9)</td>
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<td>English (SHU1)</td>
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<td>Fish Biology (SBL8)</td>
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<td>General Mathematics (SMA2)</td>
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<td>History (SSSH)</td>
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<td>Information Systems (SCS3)</td>
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<td>Law and Society (SSS4)</td>
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<td>Liberal Arts—Interdisciplinary (SHU2)</td>
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<td>Mathematics Secondary Education (SMA7)</td>
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<td>Microbiology (SBL4)</td>
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<td>Molecular Biology/Biochemistry (SBL2)</td>
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<td>Pharmaceutical Chemistry (SCHP)</td>
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<td>Physics—Secondary Education (SPH1)</td>
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<td>Plant Sciences (SBL6)</td>
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<td>Sound Design (SFSD)</td>
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<td>Statistics (SMA3)</td>
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<td>Theatre &amp; Entertainment Technology (BA) (SFTT)</td>
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<td>Theatre &amp; Entertainment Technology (BS) (SFET)</td>
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<td>Computer Network &amp; System Administration (TCSA)</td>
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<tr>
<td>Mechanical Engineering Technology—BS (TMET)</td>
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<tr>
<td>Surveying Engineering—BS (TSE)</td>
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A certificate is a body of courses that, taken together, provides students with knowledge of a disciplinary or interdisciplinary subfield. Certificates are noted on official transcripts and allow departments to offer curricular options not able to be met by a minor or a concentration within a major degree.

Departments can offer certificates to both degree-seeking and nondegree-seeking students. Nondegree-seeking students who wish to acquire a certificate must comply with procedures for admission to Michigan Tech. Students who wish to earn a certificate must indicate their interest to the appropriate department.

Certificate programs require at least 12 and no more than 25 credits, at least one-half of which must be at the 3000 level and higher. Students must earn a grade of C or better in each course that is used to meet certificate requirements. Departments offering certificates may establish GPA requirements up to 2.5.

**School of Business and Economics**
- Certificate in International Business (CIB)

**School of Business & Economics and the School of Forest Resources & Environmental Science**
- Certificate in Industrial Forestry (CIF)

**College of Engineering**
- Certificate in Design Engineering - Distance (CDE)
- Certificate in Mine Environmental Engineering (CMEE)

**College of Sciences and Arts**
- Certificate in Actuarial Science (CASC)
- Certificate in Advanced Modern Language - French (AFR)
- Certificate in Advanced Modern Language - German (AGE)
- Certificate in Advanced Modern Language - Spanish (ASP)
- Certificate in Media (CMD)
- Certificate in Modern Language - French (CFR)
- Certificate in Modern Language - German (CGE)
- Certificate in Modern Language - Spanish (CSP)
- Certificate in Writing (CWR)
Minors in an academic discipline are granted to students matriculating in a bachelor’s degree program who have completed the requirements established by academic units at Michigan Technological University. Minors are noted on diplomas and official transcripts. The purpose of a minor is to give recognition that the student has actively and consciously engaged the intellectual issues central to the discipline of the minor. Undergraduate requirements and special provisions for each minor are listed and defined by each academic unit offering the minor. Minors offered in cross-disciplinary areas must originate in a designated department, school, or multidisciplinary program as recognized by the University. Students may not take a minor with the same title as their major or major concentration.

Minors require a minimum of 16 credit hours. Of these 16 credit hours, no more than 6 credit hours may be 1000 or 2000 level courses. For minors exceeding 16 credits, the additional credits beyond 16 may be at any level. Each minor must include at least 6 credit hours of 3000 level or higher courses which are not required for a student’s major degree except as free electives. Elective courses that have been selected by a student from a prepared list or by required consultation with a major advisor in a baccalaureate program are not free electives. A minimum cumulative grade-point average of 2.0 is required for courses in the minor.

It is the responsibility of the students desiring a minor to indicate their intention to complete the requirements to Degree Services no later than the time when degree audits are filed. It is recommended that students consider minors as early as possible in their program of study.

**School of Business and Economics**
- Economics Minor (BECM)

**College of Engineering**
- Applied Geophysics Minor (EAGM)
- Earth Sciences Minor (EGLM)
- Electrical Engineering Minor (EEEM)
- Electronic Materials Minor (MSEM)
- Enterprise Minor (ENTM)
- Geological Engineering Minor (EGEM)
- Manufacturing Minor (EMMF)

- Minerals Processing Minor (CMMP)
- Mining Minor (EMGM)
- Municipal Engineering Minor (ECEM)
- Polymer Science and Engineering Minor (ECMM)
- Product Design Minor (EMPD)
- Structural Materials Minor (MSSM)

**Interdisciplinary Minors**
- Bioprocess Engineering Minor (IMBE)
- Ecology Minor (IMEC)
- Nanoscale Science & Engineering Minor (IMNT)

- Plant Biotechnology Minor (IMPB)
- Plant Sciences Minor (IMPS)
- Remote Sensing Minor (IMRS)
### College of Sciences and Arts

<table>
<thead>
<tr>
<th>Minor</th>
<th>Program</th>
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<tbody>
<tr>
<td>Aerospace Studies Minor (AFAS)</td>
<td>Historical Studies Minor (SSHS)</td>
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<tr>
<td>American Studies Minor (SSAS)</td>
<td>International French Minor (HUIF)</td>
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<tr>
<td>Art Minor (FAAR)</td>
<td>International German Minor (HUIG)</td>
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<tr>
<td>Astrophysics Minor (SPHA)</td>
<td>International Spanish Minor (HUIS)</td>
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<td>Biochemistry Minor (BLBC)</td>
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<td>Biological Sciences Minor (SBLM)</td>
<td>Journalism Minor (HUJN)</td>
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<td>Microbiology Minor (BLMB)</td>
<td>Mathematical Sciences Minor (SMAM)</td>
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<tr>
<td>Chemistry Minor (SCHM)</td>
<td>Military Arts and Science Minor (AMAS)</td>
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<tr>
<td>Coaching Fundamentals Minor (PECF)</td>
<td>Music Minor (FAMU)</td>
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<tr>
<td>Communication Studies Minor (HUCS)</td>
<td>Physics Minor (SPHM)</td>
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<tr>
<td>Computer Science Minor (SCSM)</td>
<td>Psychology Minor (PSYM)</td>
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<td>Environmental Studies Minor (SSES)</td>
<td>Social and Behavioral Studies Minor (SSBH)</td>
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<tr>
<td>Ethics and Philosophy Minor (HUEP)</td>
<td>Spanish Minor (HUS)</td>
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<tr>
<td>French Minor (HUF)</td>
<td>Technical Theatre Minor (FATT)</td>
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<tr>
<td>German Minor (HUG)</td>
<td>Theatre Arts Minor (FATA)</td>
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</table>
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 Forest Resources and Environmental Science, and School of Technology.

<table>
<thead>
<tr>
<th>College of Engineering</th>
<th>Dean</th>
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<tbody>
<tr>
<td><a href="http://www.doe.mtu.edu">www.doe.mtu.edu</a></td>
<td>Robert O. Warrington</td>
</tr>
<tr>
<td>Minerals and Materials Engineering Building, Room 712</td>
<td>Associate Dean</td>
</tr>
<tr>
<td>906-487-2005 • 906-487-2782 (fax)</td>
<td>Sheryl A. Sorby</td>
</tr>
</tbody>
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<thead>
<tr>
<th>College of Sciences and Arts</th>
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<tbody>
<tr>
<td><a href="http://www.cec.mtu.edu/csa/">www.cec.mtu.edu/csa/</a></td>
<td>Maximilian J. Seel</td>
</tr>
<tr>
<td>Walker Arts and Humanities Center, Room 201</td>
<td>Associate Dean</td>
</tr>
<tr>
<td>906-487-2156 • 906-487-3347 (fax)</td>
<td>James O. Frendewey</td>
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<thead>
<tr>
<th>School of Business and Economics</th>
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<tbody>
<tr>
<td><a href="http://www.sbe.mtu.edu/">www.sbe.mtu.edu/</a></td>
<td>Christa L. Walck</td>
</tr>
<tr>
<td>Academic Office Building, Room 103</td>
<td>Associate Dean</td>
</tr>
<tr>
<td>906-487-2668, 2205 • 906-487-2944 (fax dept.), 906-487-1863 (fax dean)</td>
<td>James O. Frendewey</td>
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<tr>
<td>forest.mtu.edu/</td>
<td>Margaret Gale</td>
</tr>
<tr>
<td>U. J. Noblet Forestry and Wood Products Building, Room 127</td>
<td>Associate Dean</td>
</tr>
<tr>
<td>906-487-2454 or 800-WOODSMI • 906-487-2915 (fax)</td>
<td>James S. Cross</td>
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<th>School of Technology</th>
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<tr>
<td><a href="http://www.tech.mtu.edu/">www.tech.mtu.edu/</a></td>
<td>Scott J. Amos</td>
</tr>
<tr>
<td>Electrical Energy Resources Center, Room 426</td>
<td>Associate Dean</td>
</tr>
<tr>
<td>906-487-2259 • 906-487-2583 (fax)</td>
<td>James S. Cross</td>
</tr>
</tbody>
</table>
Aerospace Studies
Army—Department of Military Science
Biological Sciences
Biomedical Engineering
Business and Economics
Chemical Engineering
Chemistry
Civil and Environmental Engineering
Computer Science
Education
Electrical and Computer Engineering
Exercise Science, Health and Physical Education
Engineering Fundamentals
Fine Arts
Forest Resources and Environmental Science
Geological and Mining Engineering and Sciences
Humanities
Materials Science and Engineering
Mathematical Sciences
Mechanical Engineering—Engineering Mechanics
Physics
Social Sciences
Technology
Certificate Programs
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Certificate in Modern Language - French (CFR)
Certificate in Modern Language - German (CGE)
Certificate in Modern Language - Spanish (CSP)
Certificate in Writing (CWR)

Cooperative Education (Co-op)
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. 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. Co-op assignments may range from one semester to a full year or rotate between school and work sessions.

More than 300 students participate in the program each year, employed by more than 1000 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 and internationally. For more information, go to the University Career Center or your academic department.

Double Major

- A single Michigan Tech bachelor’s degree with two majors is granted when all requirements of both curricula are satisfied at the same time. A student who completes a double major will be awarded one diploma listing both majors, for example, “BS in Mechanical Engineering and Mathematics”.

- The “double major” is distinctly different from the “second degree” in that it does not require additional credit hours beyond departmental requirements and only a single degree is granted. Double majors work best for degree programs with similar curricular structures. When two degree majors have very different requirements necessitating the completion of 32 or more “additional” credits, students should consider a second degree program that would result in the award of two, distinct baccalaureate degrees and diplomas.

- A student pursuing a double major will designate one as the primary major. In the event that a student has completed the requirements for two different degree types, such as a B. A. and a B. S., the degree corresponding to the primary major will appear on the diploma.

- If a single department offers two distinct degrees, then it is possible for a student to complete a double major within that department by fulfilling the requirements for both degrees. However, a double major will not be granted for completing two different concentrations in a single degree program.

In the event that both majors require a senior project, a student may petition both departments to accept one project for both majors prior to the date of commencing the senior project.

It is recommended that students consider Double Majors as early as possible in their program of study. Students desiring a Double Major should indicate their intent by filing a Curriculum Change Authorization form (also available in the department advising offices) with the Office of Student Records and Registration no later than the first semester of their junior year. In addition, students seeking a double major must complete a degree audit with the academic advisor in both major departments two semesters prior to their expected graduation date.

Any subsequent changes to specified courses on the degree audit must be approved on a “Petition to Alter Degree Requirements” form by the academic advisor of the major department.
Second or Dual Baccalaureate Degrees
Students seeking a second bachelors degree from Michigan Tech may obtain this degree by earning a minimum of 25 percent of the credits required for the second degree. These credits may not duplicate credits used on the primary or prior degree. The department recommending the candidate for a second degree has the final authority in determining the necessary requirements.

Students must file a Second Degree Declaration form with the advisor in the second-degree department no later than Wednesday of the second week of enrollment in order to be effective for that semester. Forms are available in the department advising offices and the Degree Services Office, Room 130A, Administration Building.

Michigan Tech has formal dual degree programs in:

- Engineering with Adrian College, Albion College, Augsburg College, Olivet College, Northland College, and the University of Wisconsin-Superior.
- Forestry with 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 Michigan Tech. Transfer student admission policies also apply to students who participate in any of the formal dual degree programs.

Dual Enrollment: 2+2
Michigan Tech has an agreement with Northwestern Michigan College that allows dual enrollment.

An undergraduate may enroll in both institutions, complete the required courses at the home institution, and automatically become either sophomores or juniors at Michigan Tech.

To be considered for the program, students must have successfully completed the high school courses listed in the "Entrance Requirements" chart and meet the general home institution admission requirements. Get additional information from the admissions offices of the dual institutions.

English as a Second Language
The English as a Second Language (ESL) Program offers ESL courses throughout the year to students interested in preparing for undergraduate or graduate study and for those interested in ESL only. Semester courses are offered at the beginning, intermediate, advanced, and academic support levels and follow the university academic schedule. With the assistance of an ESL advisor, students develop a plan for gradual transition from ESL to academic study. International transfer students may enroll in academic support courses while taking courses in their majors. Summer Intensive Language Experience (SMILE) is offered during track B of the Summer semester to students with TOEFL scores of 500 or slightly below to prepare students for academic study. SMILE includes American culture and all language skills. For more information contact the ESL program in the Graduate School.

Michigan Tech Online
Michigan Tech Online Learning is developing new and innovative technologies to deliver "live" and on-demand classes to students' workplace or home including credit courses, seminars, certificates, and professional development. BS, MS, and PhD programs are offered in mechanical engineering and electrical engineering to corporate sponsors and individuals. Several new certificates and degree programs are being developed for online distribution at both the undergraduate and graduate levels. Please contact Tech Online Learning for more information at techonline.mtu.edu.
International Programs—Study Abroad  www.ips.mtu.edu

Students can choose from five new Tech sponsored programs for a semester or year in Australia, Scotland, France, Mexico, Finland and Switzerland. Through our other partnerships, students can also study in Japan, Germany, Italy, Spain, France, Norway, Sweden, Hungary, Turkey, China, India, Costa Rica, Brazil, Argentina, and hundreds of other sites. Most of the program costs are comparable to 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, eliminating a language barrier. Finally the IPS will work with students to ensure that credits transfer back to Michigan Tech.

In addition to semester and year programs, IPS offers students a number of affordable three- to six-week summer study programs around the world. Most of these programs are led by Michigan Tech faculty and include a specialized course in the student’s major plus a language and culture course. Both courses will count toward graduation.

With international experience increasingly valued by employers, students can’t afford not to take advantage of these opportunities. Stop by the IPS for more information.

MICUP Transfer Degree Program
Michigan Tech MICUP
Unlock Your Future

The Michigan Tech Michigan College University Partnership (MICUP) Unlock Your Future Program is available for students from Delta College, Grand Rapids Community College, and Northwestern Michigan College. The program focuses on encouraging and supporting community college students (primarily academically and economically disadvantaged students and underrepresented, i.e. African Americans, Hispanic Americans, Native Americans) interested in obtaining a baccalaureate degree in Michigan Tech’s four-year degree programs.

MICUP offers career exploration, academic tutoring, comprehensive academic advising, a university residential experience, including a summer undergraduate research internship with a Michigan Tech faculty member and the opportunity to take a class. The program duration is approximately six weeks during the summer months.

For more information, contact Madeline Mercado Voelker (mmercado@mtu.edu) or Lori A. Sherman (lasherma@mtu.edu) with the Department of Educational Opportunity at 906-487-2920 or visit the website at http://outreach.mtu.edu/micup/.

Minors  www.admin.mtu.edu/em/students/graduation/minor.php

Minors in an academic discipline are granted to students matriculating in a Bachelors degree program who have completed the requirements established by academic units at Michigan Technological University. Minors are noted on diplomas and official transcripts. The purpose of a Minor is to give recognition that the student has actively and consciously engaged the intellectual issues central to the discipline of the Minor. Undergraduate requirements and special provisions for each Minor are listed and defined by each academic unit offering the Minor. Minors offered in cross-disciplinary areas must originate in a designated department, school, or multidisciplinary program as recognized by the University. Students may not take a Minor with the same title as their Major or Major Concentration.

Minors require a minimum of 16 credit hours. Of these 16 credit hours no more than 6 credit hours may be 1000 or 2000 level courses. For minors exceeding 16 credits, the additional credits beyond 16 may be at any level. Each Minor must include at least 6 credit hours of 3000 level or higher courses which are not required for a student’s Major degree except as free electives. Elective courses that have been selected by a student from a prepared list or by required consultation with a Major advisor in a Baccalaureate program are not free electives. A minimum cumulative grade-point average of 2.0 is required for courses in the Minor.
It is the responsibility of students desiring a Minor to indicate their intent by filing a Curriculum Change Authorization form with the Office of Student Records and Registration in the first semester of their junior year. It is recommended that students consider Minors as early as possible in their program of study.

- Aerospace Studies (Air Force)
- American Studies (Social Sciences)
- Applied Geophysics (Geological & Mining Engineering & Sciences)
- Art (Fine Arts)
- Astrophysics (Physics)
- Biochemistry (Biological Sciences)
- Biological Sciences (Biological Sciences)
- Bioprocess Engineering (Biological Sciences/Chemical Engineering)
- Chemistry (Chemistry)
- Coaching Fundamentals (Physical Education)
- Communication Studies (Humanities)
- Computer Science (Computer Science)
- Earth Sciences (Geological and Mining Engineering and Sciences)
- Ecology (Bio Sci/SFRES)
- Economics (SBE)
- Electronic Materials (Materials Science and Engg)
- Engineered Wood Products (SFRES)
- Enterprise (College of Engineering)
- Environmental Studies (Social Sciences)
- Ethics and Philosophy (Humanities)
- French (Humanities)
- Geological Engg (Geological and Mining Engineering and Sciences)
- German (Humanities)
- Historical Studies (Social Sciences)
- International Modern Languages Minor (Humanities)
- International Studies (Social Sciences)
- Journalism (Humanities)
- Manufacturing (Mechanical Engineering)
- Mathematical Sciences (Mathematical Sciences)
- Microbiology (Biological Sciences)
- Military Arts and Science (Army)
- Mineral Processing (Chemical Engineering)
- Mining (Geological and Mining Engineering and Sciences)
- Municipal Engineering (Civil Engineering)
- Music (Fine Arts)
- Nanoscale Science and Engineering (Physics)
- Physics (Physics)
- Plant Biotechnology (Bio Sci/SFRES)
- Plant Sciences (Bio Sci/SFRES)
- Polymer Science and Engineering (Chemical Engineering)
- Product Design (Mechanical Engineering)
- Psychology (Education)
- Remote Sensing (Geological and Mining Engineering and Sciences)
- Social and Behavioral Studies (Social Sciences)
- Spanish (Humanities)
- Structural Materials (Materials Science and Engineering)
- Technical Theatre (Fine Arts)
- Theatre Arts (Fine Arts)

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.
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 Michigan Tech 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. You must apply to the Department of Education for admission to these programs.

- Biology (BS in Biological Sciences or Clinical Laboratory Science)
- Business Administration (BS in Business Administration)
- Chemistry (BS in Chemistry)
- Computer Science (BS in Computer Science)
- Earth Science (BS in Geology)
- Economics (BS in Economics)
- English (BA in Liberal Arts)
- Integrated Science (BS in Applied Ecol & Environ Science or BS in Engineering)
- Mathematics (BS in Mathematics)
- Physics (BS in Physics)
- Social Studies (BS in Social Sciences)
- Technology and Design (BSE engineering)
Application Procedure  www.admissions.mtu.edu
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 proceeding the academic year for which you plan to enroll.
2. Submit a $40 nonrefundable application fee (check or money order) made payable to Michigan Technological University. The application fee is waived for students who submit an online application (www.mtu.edu/apply).
3. Submit official ACT or SAT test scores.
4. Freshmen: Submit application or Secondary School Information page and fee (if applicable) to high school counselor or principal.
   Transfers: Submit application, official transcripts, and fee (if applicable) to Michigan Tech Admissions Office.
   International Students: See Admissions Procedures.

Application Criteria—Admission to Michigan Tech is made on a space-available basis. Applicants are strongly encouraged to apply prior to January 15. Once students are accepted for admission, every effort is made by the faculty and staff to help students realize their potential.

Home School Policy—Michigan Tech welcomes and encourages homeschooled students to apply for undergraduate admission. Homeschooled students must supply:

- A high school transcript including a list of courses taken, grades received, or level of proficiency attained. This transcript can be from a home school curriculum agency or can be parent (or instructor) generated. A student may apply while their final coursework is still in progress.
- Official ACT or SAT test scores sent directly to Michigan Tech from the testing agency. Paper copies of scores are not considered official.
- College transcripts, if any college-level coursework has been taken.
- Official final high school transcript indicating date of graduation.

Acceptance Packet—Upon acceptance to Michigan Tech, students receive information regarding the steps necessary to enroll for their selected term.

General Information
The following describes the undergraduate admissions process. For information on graduate admissions, refer to the current Graduate School Catalog.

Application Forms—Applications may be obtained from the Michigan Tech Admissions Office or online (www.mtu.edu/apply).

Credentials—Submit credentials at least thirty days before the beginning of the semester of intended enrollment. Admission to Michigan Tech is made on a space available basis. Applicants are encouraged to apply by January 15 for priority consideration. The Application for Admission and all supporting credentials become the property of the University and will not be returned or forwarded to another institution.

Test Scores—Scores from the Scholastic Assessment Tests (SAT), or the American College Test (ACT) are used by Michigan Tech for admission, financial aid, and placement purposes. Applicants are required to take at least one of these tests. The Michigan Tech code number for the SAT is 1464; for the ACT, it is 2030. Test registration forms are available at high school counseling offices or from the testing agency.

- 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—Michigan Tech accepts earned college level credit through Advanced Placement (AP), International Baccalaureate (IB), and the College-Level Examination Program (CLEP). Specific details on these programs are available on-line (PDFs) or upon request. Placement credit is granted free of charge.

No student is required to accept AP, IB, or CLEP advanced placement.

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).

An official high school transcript must accompany the application. Applicants will be notified of their admission status as soon as completed credentials are received and evaluated by the admissions staff—typically within 2–3 weeks.

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 Michigan Tech.

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. Official transcripts from each previous college attended must be sent to the Michigan Tech Admissions Office. All transcripts become the official property of Michigan Technological University and will not be returned or issued to another institution or party.

Transfer credit—Granted in accordance with the guidelines established by the academic departments.

1. **Specific or approved course credit** is granted for courses taken (including correspondence courses) in which passing grades of C (2.00/4.00 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 Michigan Tech.

Community College Transfers—Transfer Guides are available for all Michigan Community Colleges (http://www.admissions.mtu.edu/guides.html) The Admissions Office can offer suggestions on a 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 advisors visit most Michigan and out-of-state community colleges to provide special counseling and services.

International Students
The International Programs and Services (IPS) is responsible for recruiting and supporting international students on campus. IPS issues the I-20s and is the University’s official representative for the Immigration and Naturalization Service. IPS 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 International Programs and Services 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.ips.mtu.edu.

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.

* Accepted students with low TOEFL scores should consider enrolling in the SMILE (Summer Intensive Language Experience) Program, which consists of intensive English language and American culture courses. Upon successful completion of the courses, you will be able to continue your studies at Michigan Tech.

**Admitted International Students**—An applicant is admitted to Michigan Tech 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 International Programs and Services (IPS) office.

**Guest Students**
A student who is regularly enrolled in good standing at another institution may be admitted to Michigan Tech 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 and prerequisites have been met.

**Part-time, non-degree 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/dual 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 be readmitted to Michigan Tech through the Office of Student Records and Registration. Student may request readmittance by letter, fax or e-mail and should include name, ID# and semester for which readmittance is requested or by calling the Office of Student Records and Registration at 906/487-2319. Official transcripts from all schools attended and for all credit earned since leaving the University should be submitted to Transfer Services.

A student who has been dismissed or requested to withdraw must obtain approval from the Office of Student Affairs in order to reenter the University at any time by submitting a written petition to the Office of Student Affairs prior to the semester for which the student requests readmission.

### Entrance Requirements

<table>
<thead>
<tr>
<th>Curriculum</th>
<th>Beg. Algebra 1 unit</th>
<th>Intermediate Algebra 1/2 unit</th>
<th>Geometry 1 unit</th>
<th>Trigonometry 1/2 unit</th>
<th>Chemistry or Physics 1 unit</th>
<th>Biology, Chem., or Physics 1 unit</th>
<th>English 3 units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Applied Ecology &amp; Environmental Science</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Applied Geophysics</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Applied Physics</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Biological Sciences/Bioinformatics</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
<td>x</td>
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<tr>
<td>Business Administration</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Chemistry</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
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<td>x</td>
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<tr>
<td>Clinical Laboratory Science</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Computer Science/Computer Systems</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Economics</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
<td>x</td>
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<tr>
<td>Engineering (all fields)</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Forestry</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
<td>x</td>
</tr>
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<td>Geology</td>
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<td>x</td>
<td>x</td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Liberal Arts</td>
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<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Mathematics</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Physics</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Premedicine, Predentistry</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Scientific &amp; Technical Communication</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
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<td>x</td>
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<tr>
<td>Social Sciences</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
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<tr>
<td>Software Engineering</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Surveying</td>
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<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Technology (all fields)</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Undeclared (nonengineering)</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
<td>x</td>
</tr>
</tbody>
</table>

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.

The emphasis should be placed upon basic concepts and the principles of deductive reasoning, regardless of the choice of topic. Calculus, where offered in secondary schools, should be at least a full-year course and be taken by students who are strongly prepared in algebra, geometry, trigonometry, and coordinate geometry. Unified courses containing the subjects listed above are acceptable.

An explanation of any unified courses should accompany the high school transcript.
## Basic Expenses

### 2006–07 Tuition

<table>
<thead>
<tr>
<th>Category</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Undergraduate Resident per Credit Rate</td>
<td>$275.70</td>
</tr>
<tr>
<td>Undergraduate Non-Resident per Credit Rate</td>
<td>$668.00</td>
</tr>
<tr>
<td>Graduate Resident and Non-Resident per Credit Rate</td>
<td>$500.00</td>
</tr>
<tr>
<td>Graduate Resident and Non-Resident per Credit for</td>
<td></td>
</tr>
<tr>
<td>Applied Science Education and on-campus Peace Corps Students</td>
<td>$345.00</td>
</tr>
<tr>
<td>Engineering/Computer Science Tuition fee per semester for</td>
<td></td>
</tr>
<tr>
<td>Undergraduates taking fewer than 6 credits and</td>
<td></td>
</tr>
<tr>
<td>Graduate Students taking fewer than 5 credits</td>
<td>$250.00</td>
</tr>
<tr>
<td>Engineering/Computer Science Tuition fee per semester for</td>
<td></td>
</tr>
<tr>
<td>Undergraduates taking 6 credits or more and</td>
<td></td>
</tr>
<tr>
<td>Graduate Students taking 5 credits or more</td>
<td>$500.00</td>
</tr>
</tbody>
</table>

The Engineering/Computer Science Tuition fee applies to all students in the College of Engineering—all majors except Applied Geophysics, Geology, and Geophysics and to all students in Computer Science in the College of Science and Arts. **This fee does not apply to First-Year students.**

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## Residence Hall Room and Board Rates for the Regular 2006-2007 Academic Year

### McNair Hall and Douglass Houghton Hall

<table>
<thead>
<tr>
<th>Type</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard Occupancy</td>
<td>$6,820</td>
</tr>
<tr>
<td>Single Occupancy</td>
<td>$7,998</td>
</tr>
<tr>
<td>Converted Occupancy (Standard plus one)</td>
<td>$6,355</td>
</tr>
</tbody>
</table>

### Wadsworth Hall

<table>
<thead>
<tr>
<th>Type</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard Occupancy</td>
<td>$7,037</td>
</tr>
<tr>
<td>Single Occupancy</td>
<td>$8,215</td>
</tr>
<tr>
<td><strong>Wadsworth Hall - double w/private bath</strong></td>
<td></td>
</tr>
<tr>
<td>Standard Occupancy</td>
<td>$7,595</td>
</tr>
<tr>
<td>Single Occupancy</td>
<td>$8,835</td>
</tr>
</tbody>
</table>

**Notes:**

1. Nineteen meals per week, Saturday and Sunday breakfast excluded. Rates as stated above.
2. Fourteen meals per week option. Rates as stated above, less $93.00.
3. Ten meals per week option. Rates as stated above, less $186.00.
4. Five meals per week option. Rates as stated above, less $1,147.00.

## Apartment Rental Rates for the 2006-2007 Academic Year

### Student Family Rates

<table>
<thead>
<tr>
<th>Type</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>One-Bedroom</td>
<td>$438</td>
</tr>
<tr>
<td>Two-Bedroom</td>
<td>$488</td>
</tr>
<tr>
<td>Three-Bedroom</td>
<td>$632</td>
</tr>
</tbody>
</table>

### Staff Family Rates

<table>
<thead>
<tr>
<th>Type</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>One-Bedroom</td>
<td>$519</td>
</tr>
<tr>
<td>Two-Bedroom</td>
<td>$572</td>
</tr>
<tr>
<td>Three-Bedroom</td>
<td>$712</td>
</tr>
</tbody>
</table>

### Single Student Rates (rates are per student)

<table>
<thead>
<tr>
<th>Type</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>One-Bedroom</td>
<td>$163</td>
</tr>
<tr>
<td>Three Students</td>
<td>$233</td>
</tr>
<tr>
<td>Two Students</td>
<td>$233</td>
</tr>
<tr>
<td>Four Students</td>
<td>$325</td>
</tr>
<tr>
<td>Two Students</td>
<td>$325</td>
</tr>
</tbody>
</table>
Payments

Confirming Enrollment—All students must confirm their enrollment each semester to keep their course schedule.

If no money is owed or there is a credit balance, the student must confirm enrollment by clicking the button at the bottom of the online bill or printing out a copy of the bill and processing it through the Cashiers Office by 4:00 pm (EST) on the due date.

If money is owed, payment of the amount due on the billing statement, or the amount due on the deferred payment plan contract, must be made by 4:00 pm on the payment due date.

IMPORTANT: Your enrollment must be confirmed by the due date. If late, a LATE ENROLLMENT PROCESSING FEE is assessed to your account. Your enrollment will be canceled if enrollment is not confirmed by Wednesday of the first week of classes. A Late Enrollment/Registration Fee is assessed for students that reschedule.

Bills are electronic and are available in the Student Information System.

Due Dates—All bills will be accessible on the web by going to the Student Information System. The student will be notified via MTU e-mail when bills are available. Students scheduling after the "Available Dates" listed below are advised to follow the instructions on the registration page. REGISTRATION BILLS MUST BE PROCESSED BY THE DUE DATE TO CONFIRM YOUR ENROLLMENT AND RETAIN YOUR COURSE SCHEDULE. A second billing is for adjustments occurring after the original billing date.

<table>
<thead>
<tr>
<th></th>
<th>Available Dates</th>
<th>Due Dates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Summer Semester 2006</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Registration bill</td>
<td>April 14, 2006</td>
<td>May 3, 2006</td>
</tr>
<tr>
<td></td>
<td>May 23, 2006</td>
<td>June 9, 2006</td>
</tr>
<tr>
<td>Second bill</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fall Semester 2006</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Registration bill</td>
<td>July 28, 2006</td>
<td>August 30, 2006</td>
</tr>
<tr>
<td></td>
<td>September 19, 2006</td>
<td>October 6, 2006</td>
</tr>
<tr>
<td>Second bill</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spring Semester 2007</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Registration bill</td>
<td>November 10, 2006</td>
<td>January 10, 2007</td>
</tr>
<tr>
<td></td>
<td>January 30, 2007</td>
<td>February 16, 2007</td>
</tr>
<tr>
<td>Second bill</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Summer Semester 2007</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Registration bill</td>
<td>April 13, 2007</td>
<td>May 9, 2007</td>
</tr>
<tr>
<td></td>
<td>May 29, 2007</td>
<td>June 15, 2007</td>
</tr>
<tr>
<td>Second bill</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Bill Payment—You must pay the amount due to confirm your enrollment. If no money is due, then confirm your enrollment by clicking on the confirm enrollment button on the bottom of the online bill. If late, a Late Enrollment Processing Fee is assessed to your account. Your enrollment will be canceled if enrollment is not confirmed by Wednesday of the first week of classes. A Late Enrollment/Registration Fee is assessed for students that reschedule.

Bills with no money due may be processed online.

To pay by e-check or credit card (Visa, MasterCard, or Discover) click the link on the on-line bill.

Wire transfer: information can be obtained by calling 906-487-2242.

Mail your check or money order and a copy of your billing statement to:
Michigan Tech University, Cashier's Office, 1400 Townsend Drive, Houghton MI 49931

In person at the Cashier’s Office, check, money order, or cash. Please bring a copy of the billing statement with your payment.
Deferred Payment Plan—MTU offers a deferred payment plan that can divide your student billing expenses over 3 payments during the semester for a $50 per semester fee.

The first payment will be 100% of any prior semester unpaid balance plus one third of the current amount. The current amount due is all charges for tuition/housing for the semester less that semester’s financial aid. This payment is due August 30th 5pm EST and confirms the student’s enrollment. Payments made after 5pm on August 30th and up to 5pm on September 6th are subject to a $50 late enrollment fee. If your payment is not received by 5pm EST on September 6th the student’s course schedule is dropped, payment must be processed before the student can reschedule their classes. Payments made after 5pm on September 6th are assessed a $100 late enrollment/registration fee.

The second payment will be due September 27th and will be one half of the current account balance. A $25 non refundable late payment fee will be assessed if late.

The third payment will be due October 25th and will be the account balance in its entirety. A $25 non refundable late payment fee will be assessed if late.

Please note that the amounts for the payments will be adjusted as the student changes their schedule and/or housing arrangements or if there is are changes to their financial aid award.

Attention First Time Freshmen and Transfer students: Your original billing statement was based on 15 credits. Once you have finalized your schedule you will be charged for the lab/course fees associated with those classes and any additional credits above 15 on the second and third payment.

Future deferred payment plans may be denied if the student defaults on their current plan. The student will be responsible for any collection costs associated with the collection of the account balance.

To take part in the deferred payment plan the Accounts Receivable Office must receive and approve the signed deferred payment plan promissory note. The note is available by clicking the button at the bottom of the on line bill. If you have defaulted on prior deferred payment plans this button will not appear. Once the promissory note has been received and approved by the Accounts Receivable Staff, the student may sign in to the Student Information Services Banweb, click on the payment plan button at the bottom of the on line bill, and make their payment. If the promissory note is not received, payment of the full amount is required to confirm enrollment.

Installment Payment Plan—A free prepayment plan Download Adobe Acrobat Reader is available upon request. It spreads the payments over eight installments.

Michigan Tech Delinquent Accounts Policy—Student accounts are the financial responsibility of the student and the student is considered the account holder even if payments are being made by another person such as a parent or guardian. In accordance with FERPA we are not able to give out account information to anyone but the account holder.

The following information also applies to non-student accounts with Michigan Tech.

All account balances are due within 30 days unless otherwise posted on the billing statement or on-line bill. Holds preventing university services are placed on past due accounts. A hold may prevent registration, future enrollment, and release of a grades, transcript or diploma, or further business with the university until the debt is paid in full.

Accounts that are more than 90 days past due are subject to additional collection action and in some cases additional collection fees. It is advised that if the account holder is not able to pay the delinquent balance in full at this point that they refer to the Delinquent Account Payment Plan ContractDownload Adobe Acrobat Reader or contact the Collections Coordinator at 906-487-2243 or 800-576-6484 to discuss payment options.
If we do not hear from the account holder concerning payment on a delinquent account before the account is 120 days past due we will refer the account to an outside collection agency. An account that is referred to a collection agency may be subject to additional collection costs. Michigan Tech will also disclose that the account holder has defaulted, along with other relevant information, to credit reporting agencies which will have a negative impact on the account holder’s credit history.

Delinquent account holders may use the Delinquent Account Payment Plan Contract to set up a payment plan. Ideally we would like to see the account paid in full within one year’s time. For student accounts, a hold preventing university services, including registration for classes, release of grades, transcript, or diploma will remain on a delinquent account until the balance is paid in full. For vendor accounts, a hold preventing further business with the university will remain on a delinquent account until the balance is paid in full.

Delinquent Account Payment Plan Contracts are subject to approval by Michigan Tech and once approved, it is the account holder’s responsibility to make monthly payments. We accept cash, check or credit cards for payment. Please note that we do not accept any payments by fax or phone.

If a payment is missed the account will be assessed a $25 a month late fee. If there is a default in payment as agreed the account will be referred to an outside collection agency and may be assessed additional collection costs.

It is important that the Accounts Receivable Office has a current mailing address and email for the account holder as this is our primary way of communicating with the account holder.

To discuss payment options please contact the Collections Coordinator at 906-487-2243 or 800-576-6484.

Once an account has been referred to an outside collection agency the account holder must contact that agency directly to discuss payment.

Financial Aid
Each admitted student is considered a candidate for the majority of scholarships for which he or she qualifies. Selection is made by the Scholarship Committee from the admissions application or Office of Student Records and Registration 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. Complete the FAFSA and apply for admission by February 15. Students 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, high school cumulative grade point average, 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—Scholarships for transfer students are available primarily to current or former students 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**
Michigan Tech 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 www.finaid.mtu.edu.

**Michigan Tech Scholar Awards**—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. Must be recommended for the award by a high school math or science teacher by mid-October of senior year. The award covers full-time tuition, room and board, and a $600 per year stipend.

**Presidential Scholars Program**—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 to $4,000.

**Michigan Community College Scholarships/David H. Morgan Memorial Community College Scholarships**—These merit-based awards to be used for any degree curriculum. The amount of the award varies from $1,000 up to the value of full-time tuition.

**Michigan Tech Merit Scholarships**—These merit- and need-based awards to be used for any baccalaureate curriculum are given to US citizens who are members of the current year’s high school graduating class, and who are National Merit Scholarship Qualifying Test Finalists. Michigan Tech must be listed as the first-choice university with National Merit Corporation. The value is variable from $1,000 to $2,000.

**Diversity Incentive Awards**—Merit-based awards to be used for any degree curriculum are given to US citizens who are members of underrepresented groups as defined by the University Scholarship Committee. The value varies from $1,000 up to the value of full-time tuition plus fees.

**United States Scholarships**—Merit-based awards to be used for any degree curriculum are given to US 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 Ambassador Scholarships**—Merit-based awards to be used for any degree curriculum are given to citizens or residents of any country except the USA. Accepted international students must obtain an application from the International Programs & Services Office. The value is variable from $1,000 to $6,000.

**National Scholars Award**—Merit-based awards are given to non-Michigan residents of the USA or residents of Canada. Awards to new first-year students are competitively awarded based on eligibility criteria as well as an index that considers the applicant’s high school academic record and available test scores (ACT or SAT). Values for new first-year students range from $6,000 to $12,000. Transfer students must have a minimum cumulative grade point average of 3.00 (4.00 scale), based on full-time enrollment for at least two semesters. Annual value for transfer students is $6,000.

**University Student Award**—This program is designed to provide financial assistance to both incoming students and currently enrolled students at Michigan Tech, 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 $1,300. 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—These grants are gift assistance to help undergraduate students pay educational expenses, ranging in value from $400 to $4,050.

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.

TECHAID 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 subsidized or unsubsidized student loan from the William D. Ford Federal Direct Loan Program. The subsidized loan is based on financial need. The unsubsidized loan is not need based.

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 ten 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.

- Scholarships .................................................. 12
- Federal Perkins Loan or Tech Aid .......................... 6
- Federal SEOG ..................................................... 6
- Federal Pell Grant
  - Full grant .................................................... 12
  - Three-quarter-time grant ................................. 9-11
  - Half-time grant .............................................. 6-8
  - Less than half-time grant ................................. 1-5
- University Student Award ................................ 12
- Michigan Competitive Scholarship* ................... 12

* 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 Advancement

Credits—Academic advancement is measured in terms of semester credit hours 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 0–29.99 credits
- Sophomore 30–59.99 credits
- Junior 60–89.99 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 workload 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.
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 unless approval is granted by the Office 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 Michigan Tech Student Planner & 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 Michigan Tech Student Planner & Handbook or the Academic Integrity Policy.

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.sa.mtu.edu/dean/advising](http://www.sa.mtu.edu/dean/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.admin.mtu.edu/dos/learningctrs.htm](http://www.admin.mtu.edu/dos/learningctrs.htm)

In recognition that the mind does not develop in isolation but as a result of our interactions with others, Michigan Tech 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, civil and environmental engineering, computer science, electrical and computer engineering, mathematics, mechanical engineering, physics, and writing.

The ExSEL program offers academic support through services such as peer mentoring, study groups, study skills and time management techniques, academic progress monitoring, campus resource referrals, campus and community involvement events, and career and personal development seminars.

Orientation [www.orientation.mtu.edu/](http://www.orientation.mtu.edu/)

Orientation is an informative and fun-filled week that introduces students to campus, academic life, and their classmates. It is required for all first-year students. Students will meet with academic advisors and faculty in their departments to discuss department expectations and curriculum, learn about University policies, resources, services and extracurricular activities, meet new people and become familiar with a new community and attend programs regarding life skills as well as academic concerns.

Summer Preparatory Program: MaCH-1 [www.math.mtu.edu/MaCH-I/MaCH-I.html](http://www.math.mtu.edu/MaCH-I/MaCH-I.html)

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. Weeklong 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 and of nondegree 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—Degree-seeking undergraduate students who complete 12 or more grade point credits with 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 by the Office of Student Affairs at www.sa.mtu.edu/dean/list/. Dean’s List status is recorded on the students’ transcripts. Undergraduate students who complete 12 or more grade point credits with 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 this accomplishment.

**Graduation with Honors**—Michigan Tech University recognizes the honors achievements of baccalaureate and associate degree candidates at commencement, on diplomas, and on transcripts with the Latin scholastic distinctions of *Summa Cum Laude*, *Magna Cum Laude*, and *Cum Laude*. Individual honor designations are determined by the student’s cumulative grade point average.

All grades which are on a point basis are used to determine the cumulative GPA. Grades such as I, M, N, P, Q, S, V, etc. are not included in gpa calculations.

Commencement program honor designations are based on the cumulative GPA at the close of the preceding semester. Diploma and transcript honor designations are based on the cumulative GPA achieved after successful completion of all degree requirements.

Academic Honors are granted on the following basis:

- 3.9–4.0 . . . . . . . . . . . . . . . . . . Summa Cum Laude
- 3.7–3.89 . . . . . . . . . . . . . . . . . Magna Cum Laude
- 3.5–3.69 . . . . . . . . . . . . . . . . . Cum Laude

**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 Office 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 or suspension 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 Suspension and Dismissal**—A student is eligible for academic suspension if the cumulative GPA is below 2.0 after a semester of academic probation or if the student is not restored to good academic standing after two semesters of probation regardless of the cumulative GPA. A student who receives a notice of academic suspension will not be permitted to enroll at the university for a specified period of time.
Upon receiving a first notice of academic suspension, a student must sit out for at least one semester, plus a summer. That is, a student suspended at the end of a fall semester may not re-enroll until the following fall, and a student suspended at the end of a spring semester may not re-enroll until the following spring. Upon receiving a second notice of academic suspension, a student must sit out two semesters, plus a summer. Upon reinstatement after a second suspension, failure to achieve good academic standing or show substantial academic progress within one semester will result in academic dismissal. There is no opportunity for reinstatement after academic dismissal.

**Reinstatement**—A student suspended for unsatisfactory academic progress may apply for a reinstatement through a written request to the Office of Student Affairs, after a period of nonenrollment. A student who is reinstated after academic suspension will be reinstated on academic probation, and shall be considered as having enrolled under the catalog and curriculum in effect at the time of re-enrollment.

Upon reinstatement, failure to achieve good academic standing or show substantial academic progress by the end of one semester will result in a second suspension. Upon reinstatement after a second suspension, failure to achieve good academic standing or show substantial academic progress within one semester will result in academic dismissal. There is no opportunity for reinstatement after academic dismissal.

**Academic Renewal**
Recognizing that not all first-time students are prepared for a successful academic experience, academic renewal is designed to give an undergraduate student a reasonable second chance by providing an opportunity to remove a certain portion of course work from grade point average computation. If the qualifications are met, a student may have grades for a maximum of up to two calendar years as a baccalaureate degree candidate and one calendar year for associate degree candidates removed from all calculations regarding academic standing and grade point average. Once elected, academic renewal is irrevocable.

The qualifications are:

1. A minimum of five years must have elapsed since the most recent course work to be disregarded was completed. Renewal will affect only those courses taken prior to the five (5) year absence and may be elected only once in a lifetime.
2. The petitioner must be an enrolled undergraduate student, the request must be invoked prior to graduation and is not available to students who have completed requirements for a Michigan Tech Bachelor’s or Associate’s degree.
3. A student must have an overall GPA below 2.00 for the renewal period. If more than one term is to be disregarded, they must be consecutive, completed within a maximum of two calendar years for baccalaureate degree candidates or one calendar year for associate degree candidates, with no intervening enrollments at Michigan Tech.
4. A student receiving a baccalaureate or associate degree from Michigan Tech must meet the University residency for graduation requirements in the interval between the most recent course work to be disregarded and completion of courses at Michigan Tech.

All courses remain on the student’s permanent record and grades received during the renewal period are annotated with an "R" to indicate that academic renewal was granted for the approved period. The grades received are excluded from University grade point average computations and academic standing is initialized to good standing. Renewal applies to all courses taken during the period for which it is granted, regardless of the grade earned. Course credit is granted for those courses subjected to renewal in which passing grades of C (2.00/4.00 scale) or higher have been obtained and are not subject to the existing Repeat Policy rules. The credit granted may be used towards graduation requirements.

Academic renewal is a policy of Michigan Technological University and as such may not be recognized by outside institutions or agencies (e.g., Michigan Department of Education, other universities and colleges).
Students may obtain a petition form through the Office of Student Records and Registration and must consult with their academic advisor prior to election of academic renewal. If a student left the university voluntarily, they may re-enroll by contacting the Office of Student Records and Registration. If they did not leave voluntarily they must seek re-enrollment through the Office of Student Affairs. Requests are evaluated on a case-by-case basis.

Conduct http://sa.mtu.edu/dean/judicial/policies/

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 that is indicative of good citizenship and to accept personal responsibility for their conduct that may be incongruent with University community standards. The University preserves 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 Michigan Tech Student Planner & Handbook, "Student Rights and Responsibilities in the University Community" section, and the Academic Integrity at Michigan Tech 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 laws 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 Michigan Tech 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. Michigan Tech 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, refer to the "MTU Drug and Alcohol Policy" or the pamphlet, "Policy and Procedure concerning Drugs and Alcohol," available in the Office of Student Affairs.

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/Dean of Students 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.
Grade Reports

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—Students may access their final semester grades through Banweb (Student Information System). Grades are mailed to the student only upon request. Contact the Office of Student Records and Registration for more information.

Disputed Grades—A student having an error in a final course grade should contact the instructor 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—Transcripts are provided free of charge upon request from the MTU Office of Student Records and Registration. Transcript requests are processed as they are received, and turn around time is kept to a minimum. All financial obligations to the University must be satisfied before a transcript will be released.

Online Request—If you are a current student or a former student who attended MTU since 1998 you can request a transcript online through Banweb (Student Information System). Enter your MTU student ID and PIN to login. Once you have gained access click on Student Services then Student Records. You may then select an official or unofficial transcript. If you have forgotten your PIN contact the OSRR at 906-487-2319 or email stuosrr@mtu.edu.

Former students who attended prior to 1998 may request a transcript in person, by mail, or by fax.

Request In Person—Come to the Office of Student Records and Registration with your MTU I.D. or other photo identification. Office hours are 8:00 AM to 5:00 PM during Fall and Spring Semesters and 7:30 AM to 4:00 PM during Summer Semester.

You will receive your transcript immediately upon presentation of the above.

Request By Mail—To request a transcript by mail, include your name, MTU Student ID number, address where you would like the transcript mailed to, your signature and an address or phone number in case we need to contact you. The mailing address is Michigan Technological University, Office of Student Records and Registration, 1400 Townsend Drive, Houghton, Michigan 49931.

Request By Fax—To request a transcript by fax, include your name, MTU Student ID number, address where you would like the transcript mailed to, your signature and an address or phone number in case we need to contact you. The fax number is 906-487-3343. You may also request that your Unofficial transcript be faxed.

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 GPA is computed by dividing the grade points by the grade point hours and truncating the result. 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
- F* (failure due to academic dishonesty)—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)—Grade not submitted by instructor. 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 between the beginning of the fourth week and 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.
- 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.
- E* (effort unsatisfactory due to academic dishonesty)—no credit, no grade points; given for courses taken under the Pass-Fail option.
- V (satisfactory audit)—no credit, no grade points; given for courses taken for audit.
- U (unsatisfactory audit)—no credit, no grade points; given for courses taken for audit.
- U* (unsatisfactory audit due to academic dishonesty)—no credit, no grade points; 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 six weeks after classes begin to change their registration (audit versus letter grade). After that time, changes in registration must be approved by the instructor.

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, changes in registration must be approved by the instructor.
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 (free electives only). No university-wide credit requirement can be met with an S grade.

**Graduation Residency Policy**—Students must meet the following residency requirements in order to receive a baccalaureate degree from Michigan Tech University:

a. Thirty (30) of the last 36 semester credit hours of academic work to be applied to the degree must be completed at Michigan Technological University. Study abroad and co-op credits earned through Michigan Tech may be included in these 30 hours if the student has completed 30 credit hours of courses at Michigan Tech among the last 60 credit hours to be applied to the degree.

b. Thirty (30) semester credit hours of advanced level courses (3000 or higher) must be completed at Michigan Tech.

Courses which meet the "at Michigan Tech" requirement are defined as courses listed in the course catalog and taught by Michigan Tech faculty either on campus, at field locations, or through distance learning.

**Graduation Requirements**

Students normally may expect to graduate under the requirements published in the catalog of the year they matriculate. Students who change majors or who have withdrawn from the University for a significant period of time should consult with their department chair or school dean regarding degree requirements.

Each degree candidate is expected to:

1. Successfully complete the required courses prescribed for their chosen curriculum. Petitions for exceptions must be approved by the department advisor and department chair or school dean and submitted for file with Degree Services.
2. Successfully complete the required University General Education requirements.
3. Attain a cumulative University GPA of at least 2.00, and a major department GPA of at least 2.00.
4. Comply with Michigan Tech’s graduation residency requirements.
5. File an Application for Graduation with the Degree Services Office for each degree/certificate program enrolled in.
6. Have an approved Degree Audit on file in the Degree Services Office for each degree/certificate program enrolled in.

**Undergraduate Commencement Eligibility Requirements**

Michigan Tech University conducts two commencement ceremonies each year which are held in the spring and fall semesters. Students completing all degree requirements in the spring or summer will be listed for the spring commencement ceremony and students completing their degree requirements in the fall will be listed for the fall commencement ceremony. Students who find it necessary to participate in a ceremony held prior to their graduation term due to extenuating circumstances must seek approval from the Associate Registrar for Degree Services.

In order to be eligible to participate* in a commencement ceremony and be listed in the commencement program all degree candidates must:

- Be registered in the course(s) that will complete all outstanding degree requirements.
- Have all required degree paperwork on file in the Degree Services Office two semesters prior to the expected graduation term. Required degree paperwork includes an application for graduation and a department approved degree audit for each degree being pursued and any applicable minor audit forms, double major audit forms, certificate forms, and petitions to alter forms.

* Participation in a commencement ceremony is NOT equivalent to graduation. Since the ceremony occurs before final grades are submitted, it is not possible to determine if all degree requirements are met at that time. Graduation becomes official after all grades are received and the degree notation is placed on the academic record.
Annual Notification of Student Rights
Under the Family Educational Rights and Privacy Act (FERPA)

The Family Educational Rights and Privacy Act (FERPA) affords students certain rights with respect to their education records. They are:

1. The right to inspect and review the student’s education records within 45 days of the day the University receives a request for access. Students may request to inspect their records from the appropriate record custodian. The Office of Student Records and Registration will provide assistance in identifying the correct official to whom requests should be directed.

2. The right to request the amendment of the student’s education records that the student believes is inaccurate or misleading. Students may ask the University to amend a record that they believe is inaccurate or misleading. They should write the University official responsible for the record, clearly identify the part of the record they want changed, and specify why it is inaccurate or misleading.

If the University decides not to amend the record as requested by the student, the University will notify the student of the decision and advise the student of his or her right to a hearing regarding the request for amendment. Additional information regarding the hearing procedures will be provided to the student when notified of the right to a hearing.

3. The right to consent to disclosures of personally identifiable information contained in the student's education records, except to the extent that FERPA authorizes disclosure without consent.

One exception which permits disclosure without consent is disclosure to school officials with legitimate educational interests. School officials are individuals employed by the University as researchers, teachers, advisors, counselors, placement personnel, deans, department chairs, administrative officials responsible for some part of the academic enterprise or one of the supporting activities; support staff and student personnel employed to assist university officials in the management of educational records; a person, company or agency with whom the University has contracted for a service; college or University committees (including student members), a person or company with whom Michigan Tech has contracted (such as an auditor, attorney, or collection agent). A school official has a legitimate educational interest if the official needs to review an education record in order to fulfill his or her professional responsibility.

The University may disclose education records in certain other circumstances, which are noted in the full text of Michigan Tech’s Privacy and Release of Student Educational Records policy.

The right to file a complaint with the U.S. Department of Education concerning alleged failures by the University to comply with the requirements of FERPA. The name and address of the Office that administers FERPA is: Family Policy Compliance Office, U.S. Department of Education, 600 Independence Avenue, SW., Washington, DC, 20202-4605

FERPA further provides that certain information designated as 'Directory Information', concerning the student may be released by the University unless the student has informed the University that such information should not be released. The University designates the following as public or "Directory Information": The student's name, address, telephone number, electronic mail address, hometown, age, college, major field of study, class (senior, junior, sophomore, freshmen), student status; full-time or part-time registration or not currently enrolled, student level; undergraduate/graduate, dates of attendance, participation in officially recognized activities and sports, leadership positions at Michigan Tech, weight and height of athletic team members, specific athletic achievements, MTU job title, degrees and awards received, academic and other honors, most recent previous school attended and parent/guardian names in conjunction with university awards/recognition.
As a matter of normal practice, Michigan Technological University does not sell or release "Directory Information" to commercial third parties, unless required to do so by law.

Students may restrict the release of "Directory Information", name and verification of enrollment status, except to school officials with legitimate educational interests and others as indicated above. To do so, a student must file a request to withhold directory information form with the Office of Student Records and Registration. Once filed, this request becomes a permanent part of the student’s record until the student instructs the University, in writing, to have the request removed.

Questions about FERPA may be directed to Michigan Technological University, Office of Student Records and Registration, 1400 Townsend Drive, Houghton, MI 49931-1295. The complete policy is available on the Office of Student Records and Registration Web site at: www.admin.mtu.edu/em/services/policy/

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
Registration periods for each semester are listed in the University Academic Calendar.

While every effort is made to ensure that the Schedule of Classes 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.

The most up-to-date information regarding the Schedule of Classes can be found on the web at the Schedule Planning Center: www.admin.mtu.edu/em/students/plan/

Adding Classes—The last day to officially add a full semester course is Wednesday of the second week of the semester*.

First-Year Students: Through the first five days of the semester*, signature approval must be obtained from the student’s academic advisor. After the fifth business day of the semester*, signature approval must be obtained from the student’s academic advisor and the course instructor. Section changes for the same course do not require an academic advisor approval signature.

All other students: Through the first five business days of the semester*, no signature approval is required. After the fifth business day of the semester*, students must obtain signature approval from the course instructor to add a course or change a section.

* Or the same percentage of time if a course is offered in a time module other than a fourteen week semester.

Prerequisites—Courses that are required to be satisfactorily completed before a student may register in a more advanced course. Students who earn a CD or D in a prerequisite course are encouraged to retake the prerequisite course before registering for the advanced course.
Concurrent prerequisite: a prerequisite that may be taken the same semester as the course requiring it.

Co-requisites: courses that are required to be taken together in the same semester.

The course instructor has the right to waive prerequisites, if openings are available, in the case of a student who has demonstrated competence or who has had academic experience equivalent to that represented by the prerequisite. The waiver does not grant credit for the prerequisite course, but indicates the instructor’s willingness to accept the student into their class without the student officially taking the prerequisite 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. Students with an outstanding balance will have a hold placed on their account. This hold denies access to registration and prevents the distribution of grades and transcripts.

Variable Credit Courses: The last day to change credit amounts on variable credit courses is Wednesday of the second week of the semester (or the same percentage of time if a course is offered in a time module other than a fourteen-week semester). Decreases in credits after this date will not be refunded.

Dropping Classes—Courses dropped by the close of business on Wednesday of the second week of the semester* will be refunded 100%. Courses dropped after this date will not be refunded.

During the first three weeks of a semester, courses dropped will not be recorded on the student’s permanent record. Beginning the fourth week through the end of the eighth week of the semester, courses dropped will be indicated by a grade of W on the student’s permanent record.

First-year students: During the first three weeks of instruction*, signature approval must be obtained from the student’s academic advisor. Students must be made aware of how dropping a course affects their progress toward graduation. After the third week of instruction*, signature approval must be obtained from the student’s academic advisor and the course instructor.

All other students: During the first week through the end of the eighth week of instruction*, no signature approval is required.

* Or the same percentage of time if a course is offered in a time module other than a fourteen week semester.

After the eighth week of a semester, a student may request a late drop from the Office of Student Affairs, which will consider only those requests that clearly involve extenuating circumstances beyond a student’s control. 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.

Repeating a Course—Students may not repeat courses in which they have earned a grade of C or better. When a course is repeated, the most recent grade will be used to calculate the GPA, credits earned toward graduation, and determination of class standings. Any credit previously earned under the course number is forfeited and the transcript will indicate NR (No grade-repeated) for the earlier attempt. Students must have the permission of the Office of Student Affairs and their academic advisor for the third attempt at any one course. Courses exempt from the repeat rule are those that may be repeated for credit as indicated in the course description.

Curriculum Changes—Undergraduate students considering a change to their current major should initially contact the prospective major department for information regarding restrictions or requirements for being admitted into that department. All changes are recorded on the Curriculum Change Authorization Form which is available in the department academic advising offices.
In order for this form to be processed, the student must complete the form, have it signed by the appropriate academic advisor, and submit it to the Office of Student Records and Registration before Wednesday of the second week of instruction to be effective for that semester. Curriculum changes received after that time will be effective for the following semester.

In addition to changing a primary major, the Curriculum Change Authorization Form can be used to add or change a concentration, university minor or a double major. Questions may be directed to stuosrr@mtu.edu.

For forms go to: www.admin.mtu.edu/em/students/graduation/majorchange.php

**Enrollment in Graduate Courses under "Senior Rule"**—While finishing an undergraduate degree, students are allowed to take courses which could apply to a graduate degree. However, a course cannot be applied to both a graduate and an undergraduate degree.

A Senior Rule form must be completed and submitted to the Office of Student Records and Registration prior to the end of the 6th week of class for the term in which the class is taken. Upon submission, the student’s academic record will be changed to show graduate status for the course(s) designated. Once the academic record has been changed to show graduate status for a particular course, it cannot be changed back to count toward an undergraduate degree, nor can courses from previous semesters be reclassified. Therefore, all changes to the level designation for any course on the Senior Rule form (pdf), and for which a student is registered, must be submitted by the deadline.

Students will receive two transcripts once the Senior Rule is applied to a course; one for undergraduate courses and one for graduate courses. Courses completed previously under Senior Rule (but not classified as such in the student’s academic record) will not be reclassified to appear on the graduate transcript, but the courses may be accepted on the graduate degree schedule with department advisor’s approval.

**Withdrawing from the University**

**Withdrawal Procedure**—If a student terminates their course work during the semester, it is important that their registration be formally withdrawn. Failure to submit the Student Withdrawal Form 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. Notifying the Office of Student Records and Registration helps ensure a smooth withdrawal-readmission process. Students may do this over the telephone, through the mail, or fax, but the preferable method is in person. If students are not planning to return, a formal withdrawal assures students of receiving any refunds due in a timely manner.

**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.
- 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.
MTU offers opportunities for students to participate in a multitude of activities. WebCal, an electronic calendar off Michigan Tech’s homepage, lists all University events, including student events.

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.

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.

Classes are cancelled at noon on Friday of the first week of the fall semester so that students and faculty can celebrate Keweenaw Day (K-Day). It is a celebration of the beautiful Keweenaw Peninsula, which is home to Michigan Tech. Everyone heads out to McLain State Park on Lake Superior for a day of fun, sun, music, games and food.

The Parade of Nations and Multicultural Festival, held in September, celebrate diversity with a colorful parade of flag-bearing students, who represent eighty nations, and also include a celebration of food, culture, music, and dance.

few homecoming festivities on other campuses can rival Michigan Tech’s for zaniness and all-around fun. Besides the usual Homecoming Queen and football game, there is also a Hobo Parade. The parade features cars that can barely run, thanks to some customizing by the students. The students are also dressed in their worst clothes to go along with the theme. Other Homecoming activities include a charity can drive, cardboard boat race, three-legged race, clothing strip relay, and a tailgate before the big game.

During a beautiful fall weekend, parents and families are invited to the Copper Country to explore campus, attend some cultural events, cheer the Husky football team to victory, cruise the Portage Canal, and tour the Keweenaw Peninsula as it is lit afire with the rich colors of Mother Nature. It is a weekend that will be filled with fond memories of Michigan Tech and family fun.

No Michigan Tech tradition can match Winter Carnival for national fame and overall involvement. The Winter Carnival started in 1922 and has grown to become one of the largest annual winter festivals in the nation. It features huge, intricate snow statues on campus and in the local area; a home hockey series against a tough WCHA team; men's and women's varsity basketball; skits, broomball, and other sports; sleigh rides; a Winter Carnival Queen; and more midwinter fun than you’d think was possible! Winter Carnival is held in early February with students getting two days off from classes.

On a Friday afternoon late in spring semester, students end the academic year and welcome warmer weather by engaging in activities such as pie-throwing at professors, mud volleyball (better know as oozeball), and listening to rock bands at the Spring Fling festival. Various student organizations participate in this event with food and entertainment for a campus community eager to relax and have fun before the serious business of final exams begins.
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)**
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**
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
- gymnasiunm
- 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 (7.4 k) near the SDC
- tennis courts, outdoors
- play/practice areas
- softball fields
- football/track stadium

Health Care

The Houghton Community Health Center (483-1860) provides primary medical care for the community and Michigan Tech students, their spouses, and their dependents on a fee-for-service basis.

The Clinic is located adjacent to the SDC on MacInnes Drive (open 8:30 AM-5:30 PM, Monday-Friday). Fees are payable to the Portage Health System and are not billed by the university. After-hours clinic and hospital emergency care is provided by Portage Health in Hancock, (483-1000), www.portagehealth.org.

Student Health Insurance—All students are eligible to enroll in a group health insurance plan facilitated by the University. All international students are required to purchase the University health insurance policy unless they provide proof of comparable coverage applicable in the United States. The plan is optional for domestic students, their dependents, and dependents of international students. For more information, see www.admin.mtu.edu/hro/stud%20insurance/index.shtml.

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 Office of Housing and Residence Life prior to making an off-campus housing commitment.

Housing Contract—The Office of Housing and Residence Life 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 more than 2,000 students. Each residence hall has comfortable rooms, large lounges, a dining room, laundry facilities, and recreation areas. Wadsworth Hall also has rooms with a private bath.

LIFESTYLE OPTIONS—Unique living options include the Community Governed Area and the Learning Communities: Computer Science Learning Community, First Year Experience, Forest Resources and
Environmental Science Learning Community, Healthy Living House, and International House. With the exception of the Community Governed Area, these options require an additional application, which are available on the Web at www.residencelife.mtu.edu/learningcommunity.

If you are not interested in a special community, you may select certain community traits that are consistent with your lifestyle which are Chemical Free and Smoke Free rooms in each hall.

**Chem-Free Housing** is offered in all three of our residence halls. Currently fourteen 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-five houses have this lifestyle option where residents have chosen to prohibit smoking by themselves and by their guests.

The **Community Governed Area** is a living option offered in East McNair Hall to students who are 21 and 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.

**First Year Experience**, located in Wadsworth Hall, is a living option offered to first-year students to build a solid foundation for their success in college. Seven upper-class students live on the floor and serve as resident assistants, program coordinator, and mentors. If you choose this option, you will participate in educational and social activities, as well as enroll in the University course, Creating Your Success. This area is coed and is chemical-free.

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. A resident assistant, program coordinator and a mentor plan and encourage residents to participate in the many educational and social activities on international and multicultural topics. You will be assigned to someone from a different country and culture to enhance your International House experience. This area includes a kitchenette. A 12-month housing contract is also an option for students.

The **FRES** House (Forest Resources and Environmental Science), located in Wadsworth Hall, is designed for students seeking a degree in Forestry, Applied Ecology and Environmental Sciences, or Wildlife Ecology and Management. The FRES is staffed by a resident assistant and two mentors that assist in supporting academic and social activities. Residents of FRES participate in study groups, activities lead by SFRES faculty and staff, and work together to create a strong community through their shared interests. The area is coed, chemical-free and open to first-year and upperclass students.

**Healthy Living**, located in East McNair Hall and is designed to enhance opportunities for a well-rounded and healthy academic experience. If you choose this option you will complete a wellness plan with the assistance of a Mentor, participate in educational, active, and social activities based on healthy living and be enrolled in the University course, Creating Your Success, and Healthy Living House fall retreat. The house is co-ed, chemical free, and open to returning and new residents.

The **Computer Science Learning Community** is a group of students, staff, and faculty who share academic interests and are pursuing the Computer Science, Computer Systems Science or Software Engineering. Together, students explore computer science, share ideas, make friends, study for classes, and have some fun. Students are enrolled in the same four academic courses during the fall semester, which are tied to the computer science major and include a college success course. Students will also live in a co-ed residential area on third floor East McNair Hall.

**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 $180 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 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.

**Off-Campus Housing  www.aux.mtu.edu/usghousing/**

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 graduate and undergraduate MTU students. Services include seminars, corporate speakers, career fairs, a career resource center, individual counseling, orientation sessions, on-campus interviewing, and a career guidance software program free for MTU students.

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 provide high-quality child-care for Michigan Tech students, faculty, and staff. BHK will accept children from four weeks to four years of age. For more information, call 906-482-3663 or 800-236-5657. Space is limited.

**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.

**International Programs and Services (IPS)  www.ips.mtu.edu**
The Office of International Programs and Services (IPS) offers information and services to students interested and involved in study abroad opportunities in various countries of the world. In addition, the IPS serves as a home away from home for over 600 international students on visas and provides immigration counseling, advocacy and support services to them. IPS also contributes in the internationalization of Michigan Tech University and Upper Peninsula communities by offering multiple cultural and educational programs to the university and local community. These include Intercultural Mentorship Program, International Film Festival, Parade of Nations, International Spouse Support Program, International Ambassador Program, Holidays Around the World, New International Student orientation and informational workshops.

**Educational Opportunity (EdOpp)  www.edopp.mtu.edu/**
The Department of Educational Opportunity (EdOpp), working with other Michigan Tech departments, provides academic, professional, and personal educational opportunities for students. Partnerships with industry, community colleges, and secondary schools provide resources for many EdOpp programs. EdOpp youth programs and outreach divisions support the recruitment and retention of a diverse student body. The department programs primarily focus on topics that address the needs of precollege, female, minority, and nontraditional students. EdOpp also coordinates campus and community multicultural activities, conferences and institutes, and other continuing education programs. EdOpp is a resolve for diversity and precollege information and assistance.

The department hires and trains a large number of undergraduate and graduate students to work in a variety of academic, diversity, and youth programs throughout the year.

Michigan Tech is active in the following organizations through its Outreach and Multiethnic Programs:

- AISES—American Indian Science and Engineering Society
- CSRDE—Center for Institutional Data Exchange and Analysis
- GEM—National Consortium for Graduate Degrees for Minorities in Engineering and Science Inc. (Graduate Education for Minorities)
- MentorNet—E-mentoring Network for Diversity in Engineering and Science
- MSGC—Michigan Space Grant Consortium
- NSBE—National Society of Black Engineers
- SHPE—Society of Hispanic Professional Engineers

Outreach & Multiethnic Programs, Conferences and Institutes, Educational Opportunity/Diversity Initiatives are divisions of Educational Opportunity which manage special educational events for the university.

**Information Technology (IT)  www.tc.mtu.edu/  www.ets.mtu.edu**
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, educational technology services for students including the Electronic Display System, video studios, audio-visual equipment, streaming media, and videoconferencing.
**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.museum.mtu.edu
MTU is home to one of the nation's premier collections of crystals, minerals, and ores. The A.E. Seaman Mineral Museum, the official "Mineralogical Museum of Michigan," contains more than 30,000 specimens, including the world's finest display from Michigan's copper and iron mining districts.

**Student Affairs Office**  www.studentaffairs.mtu.edu
The 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 Goals

Our general education goals, a required part of each degree, include developing in each student:

- fundamental scholastic habits of careful reading, communication, critical reasoning, balance, 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:

- Four core courses (13 semester credits) and a 15-semester-credit distribution requirement, which is usually five courses
- Science/mathematics courses (16 credits)
- Three semester units of co-curricular activities

General Education requirements are not normally waived, substituted or modified. Advisors may submit such requests if students have received incorrect advice. Requests are reviewed on an individual basis by the office of Vice Provost for Instruction for the General Education Council.

Core Courses (13 credits)

The core courses are designed to promote active engagement in learning, coherence within the curriculum, integration within and across academic disciplines, development of strong communication abilities, and development of university-level habits of mind. The core consists of the following:

- Perspectives on Inquiry (UN 1001, 3 credits)—an interdisciplinary, writing-intensive seminar taken in the first semester of the first year
- World Cultures (UN 1002, 4 credits)—an interdisciplinary lecture/lab course devoted to the human experience as understood through history, geography, and cultural anthropology. It is taken in the second semester of the first year (Note: Two semesters of a modern language along with UN 1003 World Cultures Activities may substitute for UN 1002—see General Education Options further in this section)
- Revisions (UN 2001, 3 credits)—a writing and communications course taken fall or spring of the sophomore year
- Institutions (UN 2002, 3 credits)—an interdisciplinary course on human social, political and economic institutions taken fall or spring of the sophomore year

The core courses are designed to be taken according to the above schedule and are restricted to enrollment by the class year. Some core courses also have previous core courses as prerequisites. Students who do not take these courses on schedule risk being unprepared to complete general education and subsequent graduation delays.
Distribution List (15 credits)

UN 1002 World Cultures and UN 2002 Institutions serve as prerequisites for the 15-credit distribution requirement. The distribution courses are divided between two lists, entitled: World Cultures and Institutions.

- Students must take 6 credits from each list. The final 3 credits may come from either list. A number of 2000-level distribution courses, marked with an asterisk, are designated as courses that can be taken during the first year in the same term as Perspectives and/or World Cultures.
- **9 credits must be at the 3000 level or higher.**
- If a course is labeled "activities," a student may apply no more than 3 credits of approved activities courses to satisfy this requirement.
- Transfer credits are evaluated individually for distribution credit.

Language Courses for Distribution Credit

All 15 credits of the distribution requirement may be filled with Modern Language credits providing the following criteria are met: the courses are not in the student’s native language, the courses meet the upper division requirement (3000-4000 level) of 9 credits, and any distribution course specified by the major is also taken.

International Study Abroad for Distribution Courses

General Education International transfer credit for study abroad students (students with transfer credit from institutions outside of the U.S.) will be assigned by the International Programs and Services (IPS) without regard to specific distribution list requirements. It is understood that the IPS will apply non-MTU courses to distribution based on their being equivalent or congruent with existing general education distribution courses. MTU courses taken as study-abroad will be applied to distribution list requirements based upon the distribution list the course is on.
World Cultures and Institutions serve as prerequisites for the 15-credit distribution requirement. The distribution courses are divided into two lists: World Cultures and Institutions.

Students must take six credits from each list. The final three credits can come from either list. A number of 2000-level distribution courses, marked with an asterisk, are designated as courses that can be taken during the first year in the same term as Perspectives on Inquiry and/or World Cultures.

Note the following restrictions:
- If a course is labeled “activities,” a student may apply no more than three credits of approved activities courses to satisfy this requirement.
- 9 credit hours must be at the 3000 or higher level.

Language Courses for Distribution Credit

All 15 credits of the distribution requirement may be filled with Modern Language credits providing the following criteria are met: the courses are not in the student’s native language, the courses meet the upper division requirement (3000-4000 level) of 9 credits, and any distribution course specified by the major is also taken.

International study abroad for Distribution Courses

General Education International transfer credit for study abroad students (students with transfer credit from institutions outside of the U.S.) will be assigned by International Programs and Services (IPS) without regard to specific distribution list requirements. It is understood that IPS will apply non-MTU courses to distribution based on their being equivalent or congruent with existing general education distribution courses. MTU courses taken as study-abroad will be applied to distribution list requirements based upon the distribution list the course is on.

World Cultures

(Prerequisite: UN1002)

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<td>CM3410</td>
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<td>History of Economic Thought</td>
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<td>Psychology of Coaching</td>
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<td>Communication Contexts</td>
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<td>Complex Communication Practices</td>
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<td>FA2090</td>
<td>Speech Communication</td>
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<tr>
<td>FA2150</td>
<td>Creative Drawing (activities)*</td>
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<td>FA2200</td>
<td>Watermedia I (activities)*</td>
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<td>Two-Dimensional Design (activities)*</td>
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Distribution Courses

2006-2007 Academic Year

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* Indicates course may be taken during the first year in the same term as Perspectives on Inquiry and/or World Cultures.
General Education

Science/Mathematics (16 credits)

All Michigan Tech baccalaureate graduates have a minimum of 16 credits of science, engineering, mathematics, or computer science. Check with your department or advisor for specific requirements.

Note the following restrictions:

1. At least 12 of those credits must be outside the student’s major field.
2. Students must complete 4 credit hours in mathematics at 1000 level or higher and one laboratory science course. Requiring computer science or engineering is at the discretion of the department.
3. The distribution of the required 16 credits varies by curriculum. Some programs specify all 16 credits; others do 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. 4 credits or more of MA 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 that also includes a lab component as a separate course or Archaeology Laboratory Methods SS 3220 (social sciences). A student must successfully complete both the lab and recitation portions of these courses in order to meet the requirement.
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<th>Course Title</th>
<th>Credits</th>
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General Education

General Education Options

1. **Modern Language Option for World Cultures** (UN1002) Two semesters of a single modern language taken at Michigan Tech along with UN 1003 World Cultures lab. UN1003 World Cultures lab is the 1 credit lab portion only. It is only taken by students concurrently enrolled in modern language. Students may begin their two semesters of modern language in the Fall or Spring semesters of their first year. In the spring term students choosing this option must enroll concurrently in UN1003 World Cultures lab and a modern language. Students with transfer or AP language credit, or who plan to study abroad, should see the Humanities Department Modern Language Director for advice. The two semesters of language and UN1003 meet the requirement for UN1002 and 3 hours of Distribution.

2. **Distribution Course Option Study Abroad Students** General Education international transfer credit for study abroad students (students with transfer credit from institutions outside the U.S.) will be assigned by the International Programs and Services (IPS) in the spirit of distribution list requirements. It is understood that IPS will apply non-Michigan Tech courses to distribution based on their being equivalent or congruent with existing general education distribution courses.

General Education Transfer Credit

1. After enrollment at Michigan Tech a student may not transfer in credits to meet UN 1001 and UN 1002.
2. Students may transfer in UN 2001 and UN 2002 even after enrollment at Michigan Tech but must see the Transfer Office before taking the course to verify they are taking the correct course.

The following guidelines apply only to students who transfer to Michigan Tech prior to fall 2007. Thereafter, transfer students must meet regular general education requirements

1. A student coming into Tech with 28 hours of approved General Education transfer and/or AP and/or IB credit hours has completed the Core and Distribution courses except for any major-specified Distribution course.
2. Incoming approved Distribution List transfer credits may be used by the student without regard to list and level requirements. Any remaining needed credits at Michigan Tech should be chosen from lists and level to best match Michigan Tech requirements. For example, if a student transfers in with 9 credits of lower-level World Cultures List Distribution credit then the remaining credits should be upper level and from Institutions List (except for any major-specified Distribution course). Students transferring into Michigan Tech with 15 credits of approved Distribution List credit have completed their Distribution requirement with the exception of any major-specified Distribution course, which must be taken along with core UN courses.

Co-curricular Courses (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. Repeatable courses may not be repeated for co-curricular general education credit.

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 "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.
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<td>PE 0205</td>
<td>Intermediate Bowling</td>
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<tr>
<td>PE 0206</td>
<td>Intermediate Golf</td>
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<tr>
<td>PE 0210</td>
<td>Special Topics in Physical Ed</td>
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<tr>
<td>PE 0215</td>
<td>Intermediate Swimming</td>
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<tr>
<td>PE 0216</td>
<td>Intermediate Basketball</td>
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<tr>
<td>PE 0217</td>
<td>Intermediate Hockey</td>
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<tr>
<td>PE 0218</td>
<td>Intermediate Weight Training</td>
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<tr>
<td>PE 0220</td>
<td>Intermediate Alpine Ski (Downhill)</td>
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<tr>
<td>PE 0221</td>
<td>Intermediate Snowboarding</td>
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<tr>
<td>PE 0222</td>
<td>Alpine Ski Racing</td>
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<tr>
<td>PE 0223</td>
<td>Freestyle Alpine Skiing</td>
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<td>Course</td>
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<tr>
<td>PE 0224</td>
<td>Snowboard Racing (Bordercross)</td>
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<tr>
<td>PE 0225</td>
<td>Freestyle Snowboarding</td>
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<tr>
<td>PE 0226</td>
<td>Intermediate Volleyball</td>
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<tr>
<td>PE 0227</td>
<td>Intermediate Archery</td>
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<tr>
<td>PE 0230</td>
<td>Water Polo</td>
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<tr>
<td>PE 0232</td>
<td>Intermediate Soccer</td>
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<tr>
<td>PE 0235</td>
<td>Intermediate Cross Country Ski</td>
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<tr>
<td>PE 0238</td>
<td>Intermediate Racquetball/Squash</td>
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<tr>
<td>PE 0239</td>
<td>Intermediate Badminton</td>
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<td>PE 0240</td>
<td>Intermediate Tennis</td>
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<td>PE 0246</td>
<td>Intermediate Billiards</td>
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<td>PE 0248</td>
<td>Intermediate Skating</td>
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<td>PE 0252</td>
<td>Intermediate Social Dance</td>
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<td>PE 0253</td>
<td>Intermediate Aerobics</td>
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<td>PE 0256</td>
<td>Intermediate Mountain Biking</td>
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<tr>
<td>PE 0266</td>
<td>Running for Fitness</td>
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<tr>
<td>PE 0270</td>
<td>Intermediate TaeKwonDo and Hapkido</td>
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<td>PE 0300</td>
<td>Personal Fitness</td>
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<td>PE 0301</td>
<td>Military Marksmanship</td>
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<tr>
<td>PE 0306</td>
<td>Advanced Golf</td>
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<td>PE 0315</td>
<td>Advanced Swimming</td>
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<tr>
<td>PE 0320</td>
<td>Advanced Skiing</td>
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<tr>
<td>PE 0321</td>
<td>Advanced Snowboarding</td>
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<tr>
<td>PE 0340</td>
<td>Advanced Tennis</td>
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<td>PE 0355</td>
<td>Advanced Road Biking</td>
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<tr>
<td>PE 0415</td>
<td>Individual Athletics for Seniors</td>
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<tr>
<td>PE 1470</td>
<td>Lifeguard Swimming</td>
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<tr>
<td>PE 1580</td>
<td>Water Safety Skills</td>
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<tr>
<td>PE 2000</td>
<td>Sports Officiating</td>
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<tr>
<td>PE 2010</td>
<td>Varsity Football</td>
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<tr>
<td>PE 2020</td>
<td>Varsity Basketball</td>
<td>1</td>
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<tr>
<td>PE 2028</td>
<td>Ski Patrol (Hill)</td>
<td>1</td>
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<tr>
<td>PE 2030</td>
<td>Varsity Hockey</td>
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<tr>
<td>PE 2040</td>
<td>Varsity Nordic Skiing</td>
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<tr>
<td>PE 2080</td>
<td>Varsity Track</td>
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<td>PE 2090</td>
<td>Varsity Tennis</td>
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<tr>
<td>PE 2130</td>
<td>Varsity Volleyball</td>
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<tr>
<td>PE 2140</td>
<td>Varsity Cross Country</td>
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<tr>
<td>PE 2150</td>
<td>Cross Training</td>
<td>1</td>
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<tr>
<td>PE 2230</td>
<td>Cheerleading Dance Team</td>
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<tr>
<td>PE 2240</td>
<td>Cheerleading Stunt Team</td>
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</table>
Air Force ROTC

**AF 0120 - Physical Conditioning**
Activities that promote physical conditioning. Emphasis is on individual conditioning through strength and aerobic training and team sports such as ultimate frisbee and football. Offered the first and last half of fall and spring semesters. May count once for co-curricular general education credit. Sports physical required prior to start of class (contact instructor for details).

**Credits:** 0.5; Repeatable to a Max of 1; Graded Pass/Fail Only
**Lec-Rec-Lab:** (0-0-2)
**Semesters Offered:** Fall, Spring

**AF 0130 - Air Force Elite Forces Workout**
An intense workout program that develops personal physical fitness and self-confidence. Workouts include an elite U.S. Military special operations training. Basic swimming skills required.

**Credits:** 1.0; May be repeated; Graded Pass/Fail Only
**Lec-Rec-Lab:** (0-0-2)
**Semesters Offered:** On Demand
**Restrictions:** Permission of instructor required

**AF 0230 - Precision Drill Team**
Techniques and skills involved in precision drill movements, including marching, rifle spinning, ceremonial sabre handling, and color guard performance. Each student must have or purchase an appropriate drill-team uniform. Offered first and second half of fall and spring semesters. May count once for co-curricular general education requirements. Non-cadets are required to provide a uniform cleaning deposit and purchase some non-returnable uniform items.

**Credits:** 0.5; Repeatable to a Max of 1; Graded Pass/Fail Only
**Lec-Rec-Lab:** (0-0-2)
**Semesters Offered:** Fall, Spring

**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 followership experiences.

**Credits:** 1.0
**Lec-Rec-Lab:** (0-1-2)
**Semesters Offered:** Fall

**AF 1002 - Foundations of US Air Force II**
Introduces students to the USAF and ROTC. Topics include Air Force mission, organizations, officership, professionalism, military customs, courtesies, officer opportunities, and communication skills. Leadership Laboratory is mandatory for AFROTC cadets and complements this course by providing cadets with followership experiences.

**Credits:** 1.0
**Lec-Rec-Lab:** (0-1-2)
**Semesters Offered:** Spring
AF 2001 - History of US Air & Space Power I
This course examines the history of United States air and space power from the first balloons and dirigibles up to the Korean War through key events and personalities. The course looks at United States air and space power in the context of the international political scene in war and peace. The role of women and minorities in the evolution of United States air and space power is highlighted.
Credits: 1.0
Lec-Rec-Lab: (0-1-2)
Semesters Offered: Fall
Pre-Requisite(s): UN 1002 or UN 1003

AF 2002 - History of US Air & Space Power II
This course examines the history of United States air and space power from post-Korean War to the present through key events and personalities. The course looks at United States air and space power in the context of the international political scene in war and peace. The role of women and minorities in the evolution of United States air and space power is highlighted.
Credits: 1.0
Lec-Rec-Lab: (0-1-2)
Semesters Offered: Spring
Pre-Requisite(s): UN 1002 or UN 1003

AF 3001 - Leadership Studies I
Study and practice of leadership in civilian and military organizations. Topics include leadership principles, problem solving, management fundamentals, counseling, motivation, mentoring, and effective communication. Various leadership theories are discussed. The course includes discussion, informal lecture, case studies, self-evaluation of leadership traits, and experiential exercises.
Credits: 3.0
Lec-Rec-Lab: (0-3-2)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): UN 2002

AF 3002 - Leadership Studies II
Study of leadership in civilian and military institutions. Topics include officership, team building, feedback, Air Force evaluation systems, leadership ethics, professional relations, and communication skills. The course includes discussion, informal lecture, case studies, and experiential exercises.
Credits: 3.0
Lec-Rec-Lab: (0-3-2)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore

AF 3050 - Leadership Seminar
Study of leadership issues, management functions, teams, and communications within an organization through guided discussions and experiential learning. Students experience leadership by holding a leadership position in registered MTU student organizations such as honors organizations, fraternities, sororities, Blue Key, Student Government, or ROTC.
Credits: 1.0
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring
Restrictions: Permission of instructor required; May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): UN 2002
AF 3090 - Special Topics in Aerospace Studies
Read, conduct research, and prepare reports and presentations on aerospace studies topics under the guidance of a faculty member.
Credits: variable to 3.0; Repeatable to a Max of 3
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of instructor required

AF 4001 - National Security Affairs I
This course is designed to develop an understanding of the nature of conflict and how the United States military forces are developed, organized, and employed. Topics include the need for national security, the evolution and formulation of American defense policy and strategy, the origins of regional security issues, and joint doctrine.
Credits: 3.0
Lec-Rec-Lab: (0-3-2)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): UN 2002

AF 4002 - National Security Affairs II
This course examines selected roles of the military in society, unconventional warfare, current issues affecting the military profession, and the military justice system. Special topics of interest focus on information warfare, the law of armed conflict, the military as a profession, and officership.
Credits: 3.0
Lec-Rec-Lab: (0-3-2)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore

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Army ROTC

AR 1001 - Foundations in Officership
Introduction to the challenges and competencies that are critical for effective leadership. Students learn how the personal development of "life skills" such as goal setting, stress management, physical fitness and time management relate to leadership, officership, and the Army profession.
Credits: 1.0
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Fall

AR 1003 - Basic Leadership
Overview of leadership fundamentals: problem solving, goal setting, listening skills, providing feedback and effective oral and written communication. Students explore dimensions of leadership values, attributes, skills, and actions in the context of practical hands-on interactive exercises.
Credits: 1.0
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Spring

AR 1011 - Basic Leadership Lab I
Hands-on practice of basic military skills, including basic first-aid, weapons familiarization, orienteering, individual and squad level tactics, techniques and procedures.
Credits: 1.0
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall
AR 1012 - Basic Leadership Lab II
Hands-on practice of basic military skills, including basic first-aid, cold weather survival skills, weapons familiarization, orienteering, showshoeing, individual and squad level tactics, techniques and procedures.  
Credits: 1.0  
Lec-Rec-Lab: (0-0-2)  
Semesters Offered: Spring

AR 2001 - Individ. Leadership Studies I
Explores the dimensions of creative tactical leadership using historical case studies and interactive exercises. Students practice aspects of personal motivation and team building in various situations and environments. Students are introduced to creative problem solving techniques and procedures.  
Credits: 1.0  
Lec-Rec-Lab: (0-0-2)  
Semesters Offered: Fall

AR 2002 - Individ. Leadership Studies II
Examines the challenges of leading in complex operational environments. Cross-cultural leadership challenges in a changing world are highlighted and applied to practical leadership tasks and situations. Students develop greater self awareness as they hone their communication and team building skills.  
Credits: 1.0  
Lec-Rec-Lab: (0-0-2)  
Semesters Offered: Spring

AR 2011 - Intermediate Leadership Lab I
Hands-on practice of basic military skills, including leadership of a fire team, basic first-aid, weapons familiarization, orienteering, individual and squad level tactics, techniques and procedures.  
Credits: 1.0  
Lec-Rec-Lab: (0-0-2)  
Semesters Offered: Fall

AR 2012 - Intermediate Leadership Lab II
Hands-on practice of basic military skills, including leadership of a fire team, basic first-aid, cold weather survival skills, weapons familiarization, orienteering, showshoeing, individual and squad level tactics, techniques, and procedures.  
Credits: 1.0  
Lec-Rec-Lab: (0-0-2)  
Semesters Offered: Fall

AR 2068 - Fall Military Physical Conditioning
Develops physical fitness, personal confidence, self-esteem and military skills. Students are exposed to both individual and group physical fitness procedures and techniques. Emphasis is on developing a good fitness program for each individual student. May count once for co-curricular general education credit.  
Credits: 1.0; Repeatable to a Max of 12; Graded Pass/Fail Only  
Lec-Rec-Lab: (0-0-3)  
Semesters Offered: Fall
AR 2069 - Spring Military Physical Conditioning
Develops physical fitness, personal confidence, self-esteem and military skills. Students are exposed to both individual and group physical fitness procedures and techniques. Emphasis is on developing a good fitness program for each individual student. May count once for co-curricular general education credit.
Credits: 1.0; Repeatable to a Max of 12; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Spring

AR 2075 - Ranger Challenge
The varsity sport of ROTC in which teams compete in leadership technical and tactical skills. The competition is to provide mental and physical challenges with goals of training excellence, discipline, and victory. May count once for co-curricular general education credit. Prerequisite: enrollment in ROTC or permission from Army ROTC department.
Credits: 1.0; Repeatable to a Max of 4; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall

AR 3001 - Adaptive Team Leadership
Challenging scenarios related to small unit tactics are used to develop self awareness and critical thinking skills. Cadets receive systematic and specific feedback on their leadership activities. Cadets begin to analyze and evaluate their own leadership values, attributes, skills and actions.
Credits: variable to 3.0
Semesters Offered: Fall
Co-Requisite(s): AR 3011

AR 3002 - Tactical Leadership
Uses intense situational leadership challenges to build cadet skills in leading small units. Skills in decision-making, persuading, and motivating team members are explored, evaluated, and developed. Emphasis is also placed on developing and issuing operations orders.
Credits: variable to 3.0
Semesters Offered: Spring
Co-Requisite(s): AR 3012

AR 3011 - Advanced Leadership Lab I
Hands-on practice of basic military skills, including squad and platoon leadership, basic first-aid, weapons familiarization, orienteering, and individual, squad and platoon level tactics, techniques and procedures.
Credits: 1.0
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall
Co-Requisite(s): AR 3001

AR 3012 - Advanced Leadership Lab II
Hands-on practice of basic military skills, including squad and platoon leadership, basic first-aid, weapons familiarization, orienteering, snowshoeing, cold weather survival skills, and individual, squad and platoon level tactics, techniques and procedures.
Credits: 1.0
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Spring
Co-Requisite(s): AR 3002
Pre-Requisite(s): AR 3011
AR 3014 - Airborne School
Three week course taught at the U.S. Army Airborne School teaches students the basic techniques of parachuting. Course is very physically and mentally demanding, requiring cadets to be in excellent physical condition to attend and successfully complete the course.
Credits: 1.0; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Summer
Restrictions: Permission of department required
Pre-Requisite(s): AR 1001 or AR 1002

AR 3068 - Military Physical Leadership I
Develops a cadet's leadership abilities to design, implement, and assess a platoon level Army physical training program. Cadets learn the basic leadership of designing and developing a physical conditioning program. May count once for co-curricular general education credit.
Credits: 1.0; Repeatable to a Max of 12; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Fall
Restrictions: Permission of department required; May not be enrolled in one of the following
Class(es): Freshman, Sophomore
Pre-Requisite(s): AR 2068 and AR 2069

AR 3069 - Military Physical Leadership II
Develops a cadet's leadership abilities to design, implement, and assess a platoon level Army physical training program. Cadets improve their small group's level of physical conditioning while honing their own leadership skills. May count once for co-curricular general education credit.
Credits: 1.0; Repeatable to a Max of 12
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Spring
Restrictions: Permission of department required; May not be enrolled in one of the following
Class(es): Freshman, Sophomore
Pre-Requisite(s): AR 3068

AR 3100 - Special Topics Small Group Leadership
Study and discussion of topics in Military Leadership not included in regular undergraduate courses.
Credits: variable to 3.0
Semesters Offered: On Demand
Restrictions: Permission of department required; May not be enrolled in one of the following
Class(es): Freshman

AR 4001 - Developing Adaptive Leaders
Develops proficiency in planning, executing, and assessing operations while serving as a battalion staff officer. Prepares cadets for their first unit of assignment. Cadets identify responsibilities of their staff roles and use situational opportunities to teach, train and develop subordinates.
Credits: variable to 3.0
Semesters Offered: Fall
Co-Requisite(s): AR 4011
Pre-Requisite(s): AR 3001 and AR 3002
AR 4004 - Leadership in a Complex World
Cadets apply military law, principles of war, and rules of engagement to current operations. Interaction with non-government organizations, civilians, and other nations are explored. Case studies, scenarios, and exercises prepare cadets for service as commissioned officers in the US Army.
 Credits: variable to 3.0
Semesters Offered: Spring
Co-Requisite(s): AR 4012
Pre-Requisite(s): AR 3001 and AR 3002

AR 4011 - Battalion Staff Operations I
Develops personal confidence and advanced leadership ability using basic and advanced military skills. Students are given responsibility for planning and controlling the activities of the cadet battalion. Applied creativity, problem solving, decision making, and leadership are the cornerstones of this course.
 Credits: 1.0
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall
Co-Requisite(s): AR 4001

AR 4012 - Battalion Staff Operations II
Develops personal confidence and advanced leadership ability using basic and advanced military skills. Students are given responsibility for planning and controlling the activities of the cadet battalion. Applied creativity, problem solving, decision making, and leadership are the cornerstones of this course.
 Credits: 1.0
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Spring
Co-Requisite(s): AR 4004

AR 4100 - Special Topics Leadership Development
Study and discussion of topics in Military Leadership not included in regular undergraduate courses.
 Credits: variable to 3.0
Semesters Offered: On Demand
Restrictions: Permission of department required; May not be enrolled in one of the following Class(es): Freshman, Sophomore
Business

**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:** (3-0-0)  
**Semesters Offered:** Fall, Spring, Summer

**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:** (1-0-0)  
**Semesters Offered:** Fall, 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 non-parametric techniques.

**Credits:** 3.0  
**Lec-Rec-Lab:** (3-0-0)  
**Semesters Offered:** Fall, Spring, Summer  
**Pre-Requisite(s):** MA 1135 or MA 1140 or MA 1150 or MA 1151 or MA 1160 or MA 1161 or MAT 1195

**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, Spring, Summer  
**Pre-Requisite(s):** BA 2100 or MA 2710 or MA 2720 or MA 3710

**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)  
**Semesters Offered:** Fall, Spring  
**Pre-Requisite(s):** BA 1200
BA 2210 - Web Application Development
Covers development technologies, tools, and environments of web-enabled and e-commerce business solutions. Topics include the nature of the development environment for web-based solutions, fundamentals of development technologies, desirable development practices, and design, debugging, and testing methods.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: On Demand
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): BA 2200 or CS 1121 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)
Semesters Offered: Fall, Spring, Summer
Restrictions: May not be enrolled in one of the following Class(es): 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)
Semesters Offered: Fall, Spring, Summer
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): BA 2300

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)
Semesters Offered: Fall, Spring, Summer

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 skill assessment, communication, group process and teamwork, and action planning.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring, Summer
Restrictions: May not be enrolled in one of the following Class(es): 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: (0-3-0)
Semesters Offered: Fall, Spring, Summer
Pre-Requisite(s): BA 1200 or CS 1121 or CS 1131 or EET 2241

Michigan Tech Undergraduate Course Descriptions Effective Fall 2006 <https://www.banweb.mtu.edu/pls/owa/stu_ctg_utils.p_online_all_courses_ug>
**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)  
**Semesters Offered:** Fall, Spring  
**Pre-Requisite(s):** BA 3200(C) and (BA 2200 or CS 1121 or CS 1131 or SAT 2400 or CS 1122)

**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 others 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:** (0-3-0)  
**Semesters Offered:** Fall, Spring  
**Pre-Requisite(s):** BA 3210

**BA 3280 - IS/IT Development Topics**  
Examines current IS/IT topics and issues in greater depth from a business application development perspective. Programming skills are required. A single offering of this course concentrates on one or two topics, which will vary.  
**Credits:** 3.0; Repeatable to a Max of 6  
**Lec-Rec-Lab:** (0-3-0)  
**Semesters Offered:** On Demand  
**Pre-Requisite(s):** BA 2210 or CS 1122

**BA 3290 - IS/IT Topics**  
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)  
**Semesters Offered:** On Demand  
**Pre-Requisite(s):** BA 3200

**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 multinational issues.  
**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, Sophomore  
**Pre-Requisite(s):** BA 2310
BA 3310 - Accounting Theory/Practice II
A continuation of BA3300 with theories, concepts, and practices underlying financial measurement and reporting. Focuses on the measurement and reporting of liabilities and equities, and includes multinational issues.
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, Sophomore
Pre-Requisite(s): BA 3300 and BA 3400(C)

BA 3320 - Managerial/Cost Accounting I
The primary emphasis is on 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 issues, balanced scorecard, strategic profitability analysis, and the role of accounting in contemporary management practices.
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, Sophomore
Pre-Requisite(s): BA 2310

BA 3400 - Principles of 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)
Semesters Offered: Fall, Spring, Summer
Pre-Requisite(s): BA 2310(C) and (BA 2100 or MA 2710 or MA 2720 or MA 3710)

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)
Semesters Offered: Fall - Offered alternate years beginning with the 2001-2002 academic year
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): UN 2002

BA 3580 - Legal Environment of Business
Provides an understanding of business structures, the regulatory environment of business, and the constitutional protections of property and conduct.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Summer
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore

BA 3590 - Business Law II
Continuation of BA2500. 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)
Semesters Offered: Spring
Pre-Requisite(s): BA 2500
BA 3600 - Quality Management
Current quality control and management philosophy, concepts, and tools: strategic importance, philosophies of leading sages, practices (including ISO9000 standards and Baldrige award requirements), process-focused and result-focused tools as well as statistical process control.

Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring, Summer
Pre-Requisite(s): BA 2100 or MA 2710 or MA 2720 or MA 3710

BA 3610 - Operations Management
Fundamental principles of operations and service management; includes strategic importance and relevant interrelated concepts and tools in product/process design, work systems, forecasting, inventory and materials management, just-in-time, scheduling, capacity management, and maintenance management.

Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring, Summer
Pre-Requisite(s): BA 2100 or MA 2710 or MA 2720 or MA 3710

BA 3620 - Project Management
Focuses on application of systems analysis to project definition and selection. Covers project teams, their structures, and interactions; cross-functional communication in technological project management; project management planning, scheduling, and control tools; project monitoring, evaluation, and termination; multiple project management and inter-project relations. Case study of new product process development. Requires case study reports.

Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring, Summer
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore

BA 3700 - Organizational Behavior
Covers concepts of human relations and organizational behavior through the study of people’s behavior at work. Develop understanding, attitudes, and skills leading to increased personal effectiveness.

Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring, Summer
Restrictions: May not be enrolled in one of the following Class(es): Freshman

BA 3780 - Entrepreneurship
Covers management issues associated with establishing a successful new enterprises 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: (0-3-0)
Semesters Offered: Fall, Spring, Summer
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
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: (0-3-0)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): 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)
Semesters Offered: Fall, Spring, Summer
Restrictions: May not be enrolled in one of the following Class(es): Freshman

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
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of instructor required; Must be enrolled in one of the following College(s): School of Business & Economics

BA 4200 - Telecommunications
Introduces students to telecommunications concepts, architectures and protocols, commercial offerings, hardware, software, network design, and telecommunications management, regulations, and business applications (e-commerce).
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring
Pre-Requisite(s): BA 3200(C)

BA 4210 - Advanced Information Systems
Focuses on understanding IT for competitive advantage and as an agent of transformation. Topics include managing IT infrastructure and architecture, facilitating information distribution throughout the enterprise, conducting case analyses to develop a framework for innovative Enterprise Systems to be used for sustainable competitive advantage.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, 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
Pre-Requisite(s): BA 3220 and BA 4200(C)
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.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, 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
Pre-Requisite(s): BA 3220 and BA 4200(C) and BA 2200

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.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Class(es): Senior Pre-Requisite(s): BA 3310(C) and BA 3300

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.
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, Sophomore
Pre-Requisite(s): BA 2310

BA 4320 - Managerial/Cost Accounting II
Emphasizes information requirements of contemporary 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.
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, Sophomore
Pre-Requisite(s): BA 3320

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, multi-jurisdictional operations, and entity formations, liquidations, and reorganizations.
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, Sophomore
Pre-Requisite(s): 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 system design, internal controls, the use of databases, and electronic commerce.
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, Sophomore
Pre-Requisite(s): BA 2310

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.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): 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.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Pre-Requisite(s): BA 4370

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.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): BA 3400 or EC 3400

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, class discussion, use of the computer in financial modeling, and other financial applications.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): BA 3400

BA 4450 - Special Topics in Finance
Examines current issues in Finance and other topics of interest to faculty and students in greater depth.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: On Demand
Restrictions: Permission of instructor required
Pre-Requisite(s): BA 3400 or EC 3400
BA 4460 - Derivatives and Financial Engineering
Covers the pricing and use of options, financial futures, swaps, and other derivative securities.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): 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.
Credits: variable to 3.0; Repeatable to a Max of 6
Semesters Offered: Fall, Spring
Restrictions: Permission of instructor required; May not be enrolled in one of the following Class(es): Freshman, Sophomore

BA 4480 - Global Finance
Studies international financial systems and markets. Covers the principle of comparative advantage, balance of payments, exchange rate systems, theories of international finance, identification of international risk exposures, the management and treatment of risk, and special topics of international finance.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2001-2002 academic year
Pre-Requisite(s): BA 3400

BA 4490 - Personal Financial Planning
Provides students with an overview of personal financial issues and 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
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, Sophomore
Pre-Requisite(s): BA 3400 or EC 3400

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.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall - Offered alternate years beginning with the 2000-2001 academic year
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore

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.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2000-2001 academic year
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
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.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2001-2002 academic year
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): UN 2002

BA 4600 - Management of Technology and Innovation
An evolutionary process perspective will be taken viewing how technology strategy evolves from underlying technology competences and capabilities, understanding patterns of technological innovations, development of technological capabilities and competences, the role of collaboration in innovation, and profiting from new technologies.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring
Restrictions: Must be enrolled in one of the following Class(es): Senior

BA 4620 - Supply Chain Management
Designing and managing channels of distribution, purchase and movement of goods, and transportation systems. Emphasizes design of appropriate marketing channels, advanced topics in inventory control, facility location, routing of physical flows among facilities, and design and evaluation of transportation systems
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): BA 3610 and BA 3800 and BA 2110

BA 4630 - Operations Strategy
Addresses issues in operations management, quality, finance/accounting, marketing, supply chain, and technology to provide an interdisciplinary focus on strategic planning for operations. Also addresses issues associated with global initiatives and changing technology.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand - Offered alternate years beginning with the 2002-2003 academic year
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): BA 3610

BA 4670 - Discrete Event Simulation
Introduction to discrete-event digital simulation to solve management problems with the use of special-purpose software. Computer-based modeling used for problem solving, analysis, and generating recommendations.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall - Offered alternate years beginning with the 2001-2002 academic year
Pre-Requisite(s): BA 2100 or MA 2710 or MA 2720 or MA 3710
BA 4680 - International Technology Management
Comparative international studies of economic and managerial aspects of technological innovation. Analyzes conditions, forms, and structures of management for international technological projects. Case studies of international transfer of technology. Two credits without a research report; three credits with a research report.

Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): BA 4600(C)

BA 4690 - Systems Thinking and Dynamic Modeling
Systems thinking concepts are applied to understand the complex feedback relationships that exist within a dynamic system. Uses computer-based simulators and a laboratory for experimentation to understand the side effects of proposed policies and trade-offs between short-term and long-term impacts.

Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: On Demand - Offered alternate years beginning with the 2001-2002 academic year
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): UN 2002

BA 4700 - Strategic Management
Introduction to strategy content (e.g., differentiation, diversification, and strategic alliances) and strategizing processes (e.g., decision-making and restructuring). The course emphasizes strategies and strategizing processes within technological firms.

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; Must be enrolled in one of the following Class(es): Senior
Pre-Requisite(s): BA 3200 and BA 3400 and BA 3610 and BA 3700 and BA 3800

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 international business structures from licensing to joint ventures. Develops attitudes and skills leading to increased international effectiveness.

Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior
Pre-Requisite(s): BA 3700 and EC 3100(C)

BA 4740 - Special Topics in Management
Examines additional management topics and issues in greater depth. A single offering of this course will concentrate on one or two topics which vary.

Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: On Demand
Restrictions: Permission of instructor required
Pre-Requisite(s): BA 3700
BA 4750 - Managing Change in Organizations
Studies organizational theory with an emphasis on managing change in organizations. Examines forces for change in the external environment, methodologies for managing change (design and implementation), the impact of change on people, and leaders as agents of change. Case studies and student projects prepare the student to manage change in organizations.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall - Offered alternate years beginning with the 2002-2003 academic year
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): BA 3700

BA 4760 - Strategic Leadership
Study and practice of leadership in organizations. Topics include power and influence, leadership traits and behaviors, contingent leadership, values and vision, social responsibility, and leading change. It is recommended that students previously have taken BA3700.
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): Freshman, Sophomore
Pre-Requisite(s): 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: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): 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: (0-3-0)
Semesters Offered: On Demand
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): UN 1001 and (UN 1002 or UN 1003) and UN 2001 and UN 2002

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: (0-3-0)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): 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: (0-3-0)
Semesters Offered: Fall, Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): (BA 2100 or MA 2710 or MA 2720 or MA 3710) and BA 3800

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: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): BA 3800

BA 4860 - Buyer Behavior and E-Commerce
Focuses on understanding behavior of buyers as members of relevant groups, cultures, and nations. Examines unique characteristics of e-commerce and its strategic implications for marketing management. Investigates design and implementation of marketing mix elements both online and offline.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring
Pre-Requisite(s): BA 3800

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
Pre-Requisite(s): BA 3800

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: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): BA 3800
BA 4900 - Research and Special Projects
Under the general guidance of a faculty member, students read, conduct research, and prepare reports and papers as required. The SBE's Curriculum Committee must approve the subject of the proposed project.

Credits: variable to 4.0; Repeatable to a Max of 6

Semesters Offered: On Demand

Restrictions: Permission of instructor and department required; May not be enrolled in one of the following Class(es): Freshman, Sophomore

BA 4950 - CenTILE Project
Students work on a consulting oriented team project under the guidance of a faculty advisor. The team collaborates with a client to analyze a problem, develop a project plan, summarize findings, and make recommendations.

Credits: variable to 4.0; Repeatable to a Max of 6

Semesters Offered: On Demand

Restrictions: Permission of instructor required

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

Semesters Offered: On Demand

Restrictions: Permission of instructor required; May not be enrolled in one of the following Class(es): Freshman, Sophomore

Biomedical Engineering

BE 2100 - Undergraduate Biomedical Engineering Seminar
An overview of biomedical engineering designed especially for freshmen and sophomores that includes presentations by faculty, members of the community and other guest lecturers. Topics ranging from clinical engineering through basic biomedical engineering research are covered.

Credits: 1.0

Lec-Rec-Lab: (1-0-0)

Semesters Offered: Fall, Spring

BE 2110 - Statistical Methods for Biomedical Engineering
Topics include descriptive statistics, sampling methods, probability, statistical inference, causality, elementary design of experiments, statistical process improvement methods, including Six-Sigma techniques, clinical trial methodology, and variance analysis.

Credits: 3.0

Lec-Rec-Lab: (3-0-0)

Semesters Offered: Fall

Pre-Requisite(s): MA 1135 or MA 1160

BE 2400 - Biology for Engineers I
General principles and engineering applications of science and biology, including cell biology, physiology, molecular biology, genetics, and biotechnology.

Credits: 3.0

Lec-Rec-Lab: (3-0-0)

Semesters Offered: Fall

Restrictions: May not be enrolled in one of the following Level(s): Graduate; May not be enrolled in one of the following Class(es): Junior, Senior
BE 2500 - Intro to Biostatistics
Topics include collection of data, presentation of data, statistical inference, causality, basic probability, basic epidemiology, design of clinical trials, regulation in the health industry, and an overview of the health science research culture.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: On Demand
Pre-Requisite(s): MA 1020 or MA 1032

BE 2600 - Introduction to Biomedical Engineering
Covers basis concepts of Biomedical Engineering including statistical distributions, physiological modeling, medical imaging, biomechanics, biomaterials, and biomedical instrumentation. It serves as the starting point for more advanced courses in biomedical engineering and to give students a broad yet quantitative overview of the field.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): CH 1120 and PH 2100 and MA 2160 and ENG 1102

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: (3-0-0)
Semesters Offered: Fall
Pre-Requisite(s): (BL 1040 or BE 2400) and MY 2100 and (MEEM 2150(C) or ENG 2120(C))

BE 3600 - Biomedical Instrumentation
Introduction to theory of measurement and analysis from biological systems. Covers the use of transducers, data recording and analysis systems and signal processing techniques. Laboratory includes measurements of physiological quantities from living systems.
Credits: 4.0
Lec-Rec-Lab: (3-0-2)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Major(s): Biomedical Engineering
Pre-Requisite(s): EE 3010 and 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: Fall, Spring
Restrictions: Must be enrolled in one of the following Major(s): Biomedical Engineering
Pre-Requisite(s): BL 2010 and (MEEM 2150 or ENG 2120)
**BE 4000 - Independent Study**
Students undertake an independent study under the guidance of a Biomedical Engineering faculty member. The course of study may either be research or academic and is decided upon between the study and faculty member.

**Credits:** variable to 6.0; Repeatable to a Max of 12  
**Semesters Offered:** Fall, Spring, Summer  
**Restrictions:** Permission of instructor and department required

**BE 4100 - Cell and Tissue Mechanics**
Focuses on mechanical behavior and adaption of musculoskeletal tissues including material properties, viscoelasticity, fatigue and failure. Includes the role of mechanical forces in the development, growth and adaptation of musculoskeletal tissues; cell biology and cellular mechanotransduction.

**Credits:** 3.0  
**Lec-Rec-Lab:** (3-0-0)  
**Semesters Offered:** Spring  
**Pre-Requisite(s):** BE 3750

**BE 4200 - Biology for Engineers II**
Covers, at an advanced level, the general principles and engineering applications of science and biology, including cell biology, physiology, molecular biology, genetics, and biotechnology.

**Credits:** 3.0  
**Lec-Rec-Lab:** (3-0-0)  
**Semesters Offered:** On Demand  
**Restrictions:** May not be enrolled in one of the following Class(es): Freshman, Sophomore

**BE 4210 - Exercise 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  
**Pre-Requisite(s):** BL 2020

**BE 4300 - Advanced Polymeric Biomaterials**
A specialized study of polymers used in biomedical engineering. Topics include: processing-structure-properties relationships for polymers, polymer fibers and composites, degradation of polymers, and medical applications for polymeric biomaterials.

**Credits:** 3.0  
**Lec-Rec-Lab:** (3-0-0)  
**Semesters Offered:** Fall  
**Pre-Requisite(s):** BE 3500

**BE 4400 - Bio-Heat and Mass Transfer**
This course explores principles of heat transfer and mass transfer as they relate to problems and applications in biology, medicine, and related fields.

**Credits:** 3.0  
**Lec-Rec-Lab:** (3-0-0)  
**Semesters Offered:** Spring  
**Pre-Requisite(s):** (ENG 3200 or MEEM 2200) and (MA 3520 or MA 3521)
BE 4440 - Genetic Engineering
Molecular medicine and its applications in genetic engineering will be discussed following a quick review of genetics and cell biology as well as the human disease mechanisms. In vivo, in vitro and ex vivo treatments utilizing genetically engineered products, allogeneic and autologous cell transplantation experiments will be discussed.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: On Demand

BE 4660 - Active Implantable Devices
Implantable devices which are actively delivering therapy and acting as monitoring tools will be covered. Emphasis will be on the component level design and system level integration. Each student will design an implantable device and demonstrate its feasibility with theoretical methods learned in the class.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: On Demand
Pre-Requisite(s): BE 3600

BE 4700 - Biosensors: Fabrication & Applications
This course introduces the student to the fundamentals of biosensor development and applications. It provides an understanding of biological components, immobilization methods, transducers, and fabrication techniques. In particular, microfabrication and nanofabrication of biosensors are discussed.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: On Demand - Offered alternate years beginning with the 2001-2002 academic year
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore

BE 4800 - Biomaterials Interfaces
This course introduces the students to the effects of topography and texture on the performance of biomaterials. Special emphasis is placed on tissue engineering scaffolds and microfabrication and nanofabrication techniques. Some of the topics also include self-organization of biomembranes and supramolecular systems, bioactive materials, and the molecular basis for surface recognition and masking.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: On Demand - Offered alternate years beginning with the 2002-2003 academic year

BE 4900 - Biomedical Design Fundamentals
Design considerations and professional practice issues are addressed. Ethics, regulatory affairs, and intellectual property are addressed within the context of the biomedical engineering profession. Modern tools of biomedical design are presented and applied to current problems.
Credits: 1.0
Lec-Rec-Lab: (1-0-0)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Major(s): Biomedical Engineering; May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior
Pre-Requisite(s): BE 3600 and BE 3750 and BE 3500(C)
BE 4901 - Biomedical Design Project I
Team approach is used to resolve a defined problem in biomedical engineering. Projects are selected and undertaken with faculty guidance and sponsor input. Must be senior project ready, as defined by major, substitutes for prerequisites.
Credits: 2.0
Lec-Rec-Lab: (0-1-3)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Major(s): Biomedical Engineering; May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior
Co-Requisite(s): BE 4900
Pre-Requisite(s): BE 3500(C) and BE 3600 and BE 3750

BE 4910 - Biomedical Design Project II
Continuation of Biomedical Design Project I (BE4901) under faculty guidance. Emphasizes design and testing of prototypes. Requires work project notebooks, oral and written reports, and presentations.
Credits: 3.0
Lec-Rec-Lab: (0-1-6)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior
Pre-Requisite(s): BE 4900 and BE 4901

BE 4930 - Biomedical Engineering Topics
Biomedical engineering courses will be offered on new or emerging technical subjects depending on student demand and faculty interest and expertise.
Credits: variable to 6.0; May be repeated
Semesters Offered: Fall, Spring, Summer

BE 4940 - Introduction to Tissue Engineering
Explores the application of engineering principles toward the construction/reconstruction of human tissue. Fundamental biological principles involved in tissue engineering are reviewed from an engineering perspective with examples of engineered tissues such as blood vessels, skin, liver, cartilage and bone.
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, Sophomore
Pre-Requisite(s): (BL 1040 or BE 2400) and BL 2020

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Biological Sciences

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 other career options for the clinical laboratory scientist. Credits do not count toward graduation.
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
BL 1010 - General Biology I
A discussion of the principles of ecology and organismal biology, using the theme of physiological ecology and adaptations. This course will emphasize biodiversity, scientific method, experimental design and written and oral presentation of results.
Credits: 4.0
Lec-Rec-Lab: (3-0-3)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Major(s): Biological Sciences, Clinical Laboratory Science

BL 1020 - 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): Biological Sciences, Clinical Laboratory Science
Pre-Requisite(s): BL 1010

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 1580 - Introduction to Biological Sciences
Introduction to fields and career opportunities in the biological sciences.
Credits: 1.0; Graded Pass/Fail Only
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 subdisciplines, 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 recognition and use of common prefixes, roots, and suffixes, 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 1800 - Biochemistry Orientation
Introduction to current research and career opportunities in biochemistry with emphasis on the interdisciplinary nature of the field.
**Credits:** 1.0  
**Lec-Rec-Lab:** (0-1-0)  
**Semesters Offered:** Fall  
**Restrictions:** Must be enrolled in one of the following College(s): College of Sciences & Arts

BL 1900 - Molecular Biology Seminar
Discussion of current molecular topics in modern biology. Topics include applications in medicine and agriculture, gene therapy, genetically modified organisms, cloning, stem cells, use of these problem solving techniques in forensics and genetic disease, ethics.
**Credits:** 1.0  
**Lec-Rec-Lab:** (0-1-0)  
**Semesters Offered:** Spring

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  
**Pre-Requisite(s):** CH 1110 or CH 1100

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  
**Pre-Requisite(s):** 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  
**Pre-Requisite(s):** BL 2010
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
Pre-Requisite(s): BL 2011 and BL 2020(C)

BL 2100 - Principles of Biochemistry
Introductory overview to biochemistry. Topics include the biochemistry of amino acids, proteins, coenzymes, carbohydrates, nucleotides, nucleic acids, lipids, and water, as well as bioenergetics and photosynthesis.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Summer
Pre-Requisite(s): (BL 1040 or BL 1020) and (CH 1110 or CH 1100)

BL 2160 - Botany
Covers structure, function, reproduction, and classification of plants and algae, relating these current ecological, agricultural, or other human issues.
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 metazoan phyla, their physiology, development, ecology, behavior, natural history, and systematics. Emphasizes invertebrates other than insects.
Credits: 4.0
Lec-Rec-Lab: (3-0-3)
Semesters Offered: Fall
Pre-Requisite(s): BL 1010 or BL 1040

BL 2200 - Genetics
A study of classical and molecular genetics. Topics include one- and two-locus genetics, recombination, gene structure, 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
Pre-Requisite(s): (BL 1020 or BL 1040) and (BL 2100 or CH 4710)

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: (0-0-3)
Semesters Offered: Spring
Pre-Requisite(s): BL 2200(C)
BL 2310 - Molecular Biology Computational Lab
Use of computational tools to analyze molecular biology. Applications in medicine, agriculture and biotechnology.

Credits: 1.0
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Spring
Pre-Requisite(s): (BL 1040 or BL 1020) and BL 2100

BL 2400 - Biology for Engineers I
General principles and engineering applications of science and biology, including cell biology, physiology, molecular biology, genetics, and biotechnology.

Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Level(s): Graduate; May not be enrolled in one of the following Class(es): Senior

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: (2-0-3)
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
Pre-Requisite(s): BL 1020 and BL 1710

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
Pre-Requisite(s): UN 2002

BL 3070 - Biology & Occupational Hygiene
The first third of this course will cover fundamentals of cellular and organismal biology. The remainder of the course covers the toxic effects of occupational chemicals, energy forms and industrial pollutants on human tissue. Emphasizes recognition, evaluation, and control of health hazards in the workplace.

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
Pre-Requisite(s): CH 1140 or CH 2400 or (CH 2410 and CH 2420)

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: Spring
Pre-Requisite(s): 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: May not be enrolled in one of the following Class(es): Freshman, Sophomore  
Pre-Requisite(s): (BL 1020 or BL 1040) and (BL 2100 or CH 4710)  

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: Spring  
Pre-Requisite(s): BL 3210  

BL 3240 - Cell Biology  
Structure and function of eukaryotic cells are examined in detail.  
Credits: 3.0  
Lec-Rec-Lab: (3-0-0)  
Semesters Offered: Spring  
Pre-Requisite(s): (BL 2100 or CH 4710) and (CH 2420(C) or CH 2400)  

BL 3300 - Introduction to Genomics  
Introduction to Genomics. Genome organization, mapping and characterization from humans and related organisms. Topics include hierarchical arrangement of genes, genome mapping, molecular markers of physical genome maps, genome sequencing, comparative genomics, analysis of important human genes and their products, and ethical and legal aspects of genomics.  
Credits: 3.0  
Lec-Rec-Lab: (3-0-0)  
Semesters Offered: Fall  
Restrictions: May not be enrolled in one of the following Class(es): Freshman  
Pre-Requisite(s): BL 2200  

BL 3310 - Environmental Microbiology  
General principles of microbiology, focusing on both the use and control of microorganisms. 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; May not be enrolled in one of the following Class(es): Freshman, Sophomore  
Pre-Requisite(s): BL 1040 or BL 3070  

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: Fall  
Pre-Requisite(s): 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:** (3-0-0)  
**Semesters Offered:** Spring  
**Restrictions:** Must be enrolled in one of the following Major(s): Biomedical Engineering, Bioinformatics, Biological Sciences, Clinical Laboratory Science; May not be enrolled in one of the following Class(es): Freshman  
**Pre-Requisite(s):** BL 1020 or BL 1040 or BL 2020

BL 3780 - Medical Parasitology Laboratory
Stresses the visual identification of common human parasites.

**Credits:** 1.0  
**Lec-Rec-Lab:** (0-0-3)  
**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, Sophomore  
**Pre-Requisite(s):** BL 1710 and BL 2410

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, carcinogenic and teratogenic effects, and target organs. Discussion covers case studies of community poisoning, toxin regulation, and political debate.

**Credits:** 3.0  
**Lec-Rec-Lab:** (1-2-0)  
**Semesters Offered:** Spring - Offered alternate years beginning with the 2000-2001 academic year  
**Restrictions:** May not be enrolled in one of the following Class(es): Freshman  
**Pre-Requisite(s):** UN 2002

BL 3970 - 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  
**Pre-Requisite(s):** 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  
**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
Semesters Offered: Fall, Spring, Summer
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
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of instructor required; Must be enrolled in one of the following Major(s): Bioinformatics, Biological Sciences, Clinical Laboratory Science

BL 4010 - Biochemistry I
Structure, biochemical properties, and function of important biomolecules such as proteins and nucleic acids. Introduces enzyme biochemistry (structure, function, catalysis, kinetics, and inhibition).
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Pre-Requisite(s): (BL 1020 or BL 1040 or BL 2010) and BL 2100 and (CH 2400 or CH 2420)

BL 4020 - Biochemistry II
Dynamic aspects of living systems. Broad exposure to cellular metabolic pathways, intermediary metabolism and its regulation and bioenergetics.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Pre-Requisite(s): BL 4010

BL 4030 - Molecular Biology
Molecular biology of gene structure, expression and regulation. Also topics covering various molecular techniques and applications of these techniques and biotechnology.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): (BL 1020 or BL 1040) and (BL 2100 or CH 4710)

BL 4090 - Tropical Island Biology
A survey of island biology, including marine and terrestrial habitats. Topics include formation of carbonate islands, geological history of the Bahamas, island plant communities, intertidal, grass bed, mangrove and coral reef communities. Special course fees. Consult department before enrolling. Completion of BL1020 or BL1040 desirable but not necessary.
Credits: 2.0
Lec-Rec-Lab: (0-2-0)
Semesters Offered: Spring

BL 4100 - Special Topics in Biological Sciences
A study of recent developments in the biological sciences. Credits: variable to 10.0; Repeatable to a Max of 10
Semesters Offered: Fall, Spring
BL 4130 - Phycology
Morphology, distribution, physiology, ultrastructure, taxonomy, and economic significance of freshwater and marine algae.
Credits: 3.0
Lec-Rec-Lab: (0-2-3)
Semesters Offered: Fall - Offered alternate years beginning with the 2001-2002 academic year
Pre-Requisite(s): BL 2160

BL 4140 - Plant Physiology
Physiology and biochemistry of plants. Emphasizes photosynthesis, plant hormones, water and nutrient relations, and light-regulated development.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2005-2006 academic year
Pre-Requisite(s): BL 2160 and CH 2420

BL 4210 - Exercise 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: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): BL 2020

BL 4211 - Exercise Physiology Laboratory
A companion course to BE4210 or BL4210. Hands-on experience in making physiological measurements as related to exercise. Cardiovascular and respiratory changes during exercise will be monitored. A virtual lab is used to simulate changes in physiological measurements that cannot be performed on live subjects. A student designed laboratory project is required.
Credits: 1.0
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Fall
Pre-Requisite(s): BL 4210(C) or BL 4210(C)

BL 4220 - Applied and Industrial Microbiology
Discussion of microbial involvement in areas such as industrial production processes, biodeterioration, and organic and inorganic waste treatment. Also reviews current literature in these areas.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2001-2002 academic year
Pre-Requisite(s): BL 3210 or BL 3310

BL 4230 - Virology
Comparison of bacterial, animal, and plant viruses, including a detailed study of viral structure and host-virus interaction in the viral replication process. Discusses important current areas of viral research, viralimmune suppression, and oncogene theory.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall - Offered alternate years beginning with the 2003-2004 academic year
Pre-Requisite(s): BL 2100(C)
BL 4320 - Histology
Basic tissue structures and organs of the vertebrate organisms with emphasis on the human.
Credits: 4.0
Lec-Rec-Lab: (0-3-3)
Semesters Offered: Spring
Pre-Requisite(s): BL 2010 and BL 2020

BL 4330 - Embryology Laboratory
Laboratory study of developmental events in the star fish, frog, chicken, and pig using living and preserved materials. Topics include fertilization, cleavage, gastrulation, metamorphosis, and regeneration.
Credits: 1.0
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Spring; Offered alternate years beginning with the 2006-2007 academic year
Pre-Requisite(s): BL 2010 and BL 2020

BL 4350 - Developmental Biology
The study of the development of individual from fertilization to the adult, including the genetic basis of development, cellular differentiation, morphogenesis, metamorphosis, regeneration, and aging. Introduction to the medical application of developmental principles.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall; Offered alternate years beginning with the 2006-2007 academic year
Pre-Requisite(s): BL 2100 and BL 2200

BL 4380 - Cardiopulmonary Physiology
Using a problem-based learning approach, course examines the physiology of the human body. In-class case-study analyses provide in-depth learning about the cardiovascular and pulmonary systems and their relationship with other organ systems. Promotes development of problem-solving skills.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Pre-Requisite(s): BL 2020

BL 4430 - Biological Simulation Techniques
Introduction to the use of mathematical techniques for simulation of biological phenomena, including programming techniques for computers.
Credits: 3.0
Lec-Rec-Lab: (0-2-3)
Semesters Offered: Spring
Pre-Requisite(s): (BL 1020 or BL 1040) and (MA 1135 or MA 1150 or MA 1151 or MA 1160 or MA 1161)

BL 4440 - Fish Biology
Fishes and their habitat, native and exotic fishes of the Great Lakes region, and ocean fishery resources will be examined. Basic topics in Ichthyology and fish ecology, evolution, genetics, reproduction strategies and identification of early life stages, fish community structure, food webs and dynamics. Laboratory exercises on sampling, identification and classification of fishes and basic fish anatomy and discussion of scientific papers relevant to the subject material.
Credits: 4.0
Lec-Rec-Lab: (3-0-3)
Semesters Offered: Spring; Offered alternate years beginning with the 2006-2007 academic year
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): BL 1020 or BL 1040
BL 4450 - Limnology
Introductory study of interrelated physical, chemical, and biological processes of freshwater lakes. Field work on local lakes emphasized.
Credits: 4.0
Lec-Rec-Lab: (0-3-3)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): CH 1120

BL 4460 - Biodiversity & Freshwater Ecosystems
Course is designed for upper level undergraduates and graduate students interested in a broader understanding of Biodiversity and life’s most precious and necessary resource - freshwater. Class will be a discussion of book chapters, scientific journal articles, contributed case study presentations by students and a semester paper.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2007-2008 academic year
Pre-Requisite(s): BL 1020 or BL 1040 or BL 3400

BL 4470 - Analysis of Biological Data
Methods and techniques of analyzing quantitative biological data and of designing biological experiments.
Credits: 4.0
Lec-Rec-Lab: (3-1-0)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): MA 1135 or MA 1140 or MA 1150 or MA 1151 or MA 1160 or MA 1161

BL 4500 - Critical Discussions in Bioinformatics
Critical discussions of current topics in bioinformatics. Oral and written presentations requiring synthesis of information from various sources including primary literature.
Credits: 2.0
Lec-Rec-Lab: (0-2-0)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): BL 3300

BL 4510 - Senior Essay
Reading, interpreting, and integrating information from the primary literature of biological sciences. Emphasizes oral and written presentation skills.
Credits: 2.0
Lec-Rec-Lab: (0-2-0)
Semesters Offered: Fall, Spring
Restrictions: Must be enrolled in one of the following Major(s): Biological Sciences; May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior
**BL 4550 - Clinical Chemistry**
Theory and technique used in the routine and experimental analysis of body fluids. Includes the study of kidney and liver functions, electrolytes, medically important enzymes, protein electrophoresis, microanalytical techniques, and the use of automated analytical equipment.

**Credits:** 3.0  
**Lec-Rec-Lab:** (2-0-3)  
**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, Sophomore  
**Pre-Requisite(s):** BL 2020 and BL 2410 and BL 3640

**BL 4610 - Clinical Laboratory Science Clinical Practicum I**
Practical and didactic training in clinical chemistry, immunopathology, and medical microbiology under the direction of National Accrediting Agency for the Clinical Laboratory Sciences (NAACLS)-approved/accredited hospital internship program personnel.

**Credits:** 15.0  
**Lec-Rec-Lab:** (15-0-0)  
**Semesters Offered:** Fall  
**Restrictions:** Must be enrolled in one of the following Major(s): Clinical Laboratory Science

**BL 4611 - Clinical Laboratory Science Clinical Practicum II**
Practical and didactic training in hematology, urinalysis, and immunohematology under the direction of National Accrediting Agency for the Clinical Laboratory Sciences(NAACLS)-approved/accredited hospital internship program personnel.

**Credits:** 15.0  
**Lec-Rec-Lab:** (15-0-0)  
**Semesters Offered:** Spring  
**Restrictions:** Must be enrolled in one of the following Major(s): Clinical Laboratory Science  
**Pre-Requisite(s):** BL 4610

**BL 4620 - Histotechnology Practicum I**
Practical and didactic training in sample processing, microtome use, staining, instrumentation, grossing, embedding, and microscopy under the direction of National Accrediting Agency for the Clinical Laboratory Sciences (NAACLS)-approved/accredited hospital internship program personnel. Acceptance by a NAACLS-approved/accredited histological technology and/or histotechnologist hospital internship program required.

**Credits:** 14.0  
**Lec-Rec-Lab:** (14-0-0)  
**Semesters Offered:** Fall  
**Restrictions:** Must be enrolled in one of the following Major(s): Clinical Laboratory Science

**BL 4621 - Histotechnology Practicum II**
Practical and didactic training in histochemistry, DNA immunohistochemistry techniques, research methods, management, and safety under the direction of National Accrediting Agency for the Clinical Laboratory Sciences (NAACLS)-approved/accredited hospital internship program personnel.

**Credits:** 14.0  
**Lec-Rec-Lab:** (14-0-0)  
**Semesters Offered:** Spring  
**Restrictions:** Must be enrolled in one of the following Major(s): Clinical Laboratory Science  
**Pre-Requisite(s):** BL 4620
BL 4630 - Cytotechnology Practicum I
Practical and didactic training in recognition of normal cells and cellular changes, particularly malignant, in the female reproductive tract, respiratory tract, and gastrointestinal tract under the direction of Committee on Accreditation of Allied Health Education Programs (CAAHEP)-approved/accredited hospital internship program personnel. Acceptance by a CAAHEP-approved/accredited cytotechnology hospital internship program required.
Credits: 14.0
Lec-Rec-Lab: (14-0-0)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Major(s): Clinical Laboratory Science

BL 4631 - Cytotechnology Practicum II
Practical and didactic training in normal cell identification and recognition of cellular changes with emphasis on the diagnosis of cancer in the urinary, excretory, and neurological systems under the direction of Committee on Accreditation of Allied Health Education Programs (CAAHEP)-approved/accredited hospital internship program personnel.
Credits: 14.0
Lec-Rec-Lab: (14-0-0)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Major(s): Clinical Laboratory Science
Pre-Requisite(s): BL 4630

BL 4640 - Clinical Immunology & Serology
Integrates basic and clinical immunological principles as well as outlines the diagnosis and evaluation of immune disorders and selected infectious diseases.
Credits: 2.0
Lec-Rec-Lab: (2-0-0)
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, Sophomore
Pre-Requisite(s): BL 1710 and BL 2410 and BL 3640

BL 4660 - Current Topics in Clinical Laboratory Science
Recent developments in Clinical Laboratory Science.
Credits: variable to 4.0; Repeatable to a Max of 6
Semesters Offered: Fall, Spring
Restrictions: Permission of instructor required

BL 4710 - Hematology & Immunohematology
Study of the morphological, biochemical, and functional aspects of blood cells, blood coagulation, and blood-banking principles of donor and recipient testing, and the rationale for and hazards of blood transfusion. Lab emphasizes techniques for analyzing the cells of the peripheral blood and for determining transfusion compatibility.
Credits: 4.0
Lec-Rec-Lab: (3-0-3)
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, Sophomore
Pre-Requisite(s): BL 2020 and BL 2200 and BL 2410 and BL 3640 and BL 4640(C)
BL 4740 - Introduction to Mycology
The taxonomy and biology of major groups of fungi, focusing on their ecology and physiology. Emphasizes organisms of interest in medicine and forest ecology.

Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Fall - Offered alternate years beginning with the 2004-2005 academic year
Pre-Requisite(s): BL 1020 or BL 1040

BL 4750 - Clinical Laboratory Instrumentation
An overview of the principles, applications, and selection of instruments used in clinical laboratory. Lab work includes operation, maintenance, and trouble shooting to obtain experience working with power supplies, centrifuges, spectrophotometers, pH meters, osmometers, radiation counters, and chemistry analyzers, blood cell counters, and other instruments commonly used in a diagnostic laboratory.

Credits: 2.0
Lec-Rec-Lab: (0-1-3)
Semesters Offered: Spring

BL 4810 - Plant Taxonomy
The classification system and the criteria for classification employed in the plant kingdom with emphasis on identification of vascular plants. A three-week field course during 1st track of summer semester. Class days include Saturdays.

Credits: 3.0
Lec-Rec-Lab: (0-2-3)
Semesters Offered: Summer

BL 4820 - Biochemical Laboratory Techniques I
Laboratory techniques basic to biochemistry and molecular biology including protein and phospholipid determinations, purification of natural and recombinant enzymes, enzyme kinetics, polyacrylamide gel electrophoresis, techniques of cell disruption, membrane isolation and purification using sucrose density gradients, phospholipid and fatty acid compositional analysis.

Credits: 2.0
Lec-Rec-Lab: (0-1-3)
Semesters Offered: Spring
Pre-Requisite(s): BL 4010(C) or CH 4710(C)

BL 4830 - Advanced Biochemical Techniques
Advanced Biochemical Techniques is designed to provide students with a rigorous exposure to the techniques and procedures utilized in the areas of Biochemistry. Emphasis will be placed on an active role of the student in the design of experiments and the collection and interpretation of biochemical data. Students will use microbial systems to construct and characterize experimental strains, monitor and interpret growth data and evaluate microbial regulatory systems via the use of measurements of enzyme specific activity, cell growth and viability and protein and nucleic acid synthesis.

Credits: 2.0
Lec-Rec-Lab: (1-0-3)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): (BL 4010 or CH 4710) and BL 4820
BL 4840 - Molecular Biology Techniques
Laboratory techniques in molecular biology, including methods of recombinant DNA technology for identification, cloning, and characterization of genes.

Credits: 3.0
Lec-Rec-Lab: (1-0-4)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): (BL 1020 or BL 1040) and (BL 2100 or CH 4710) 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
Pre-Requisite(s): BL 1020 or BL 1040

BL 4979 - Clinical Laboratory Administration and Management
A study of laboratory management and administration. Topics include human resource management, financial management, operations management and career success. Basic laboratory statistics will be covered with the emphasis on quality assurance and total quality management.

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; May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): BL 2410

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; May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): BL 2410 and BL 3230(C) and BL 4550(C) and BL 4640 and BL 4710

BL 4995 - Research in Biochemistry
A literature and laboratory research problem in biochemistry that culminates in a written report on the work performed.

Credits: variable to 6.0; Repeatable to a Max of 9
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of instructor required; Must be enrolled in one of the following Major(s): Bioinformatics, Biological Sciences, Chemistry, Clinical Laboratory Science; May not be enrolled in one of the following Class(es): Freshman
Civil & Environmental Engng

CE 1000 - Civil Engineering
An introduction to the civil engineering profession with emphasis on careers open to the civil engineering students. Topics include: scope, specialties, education, professional practice, life-long learning, contemporary issues, ethics and societal impacts related to civil engineering.

Credits: 1.0
Lec-Rec-Lab: (1-0-0)
Semesters Offered: Fall

CE 1501 - Experiences in Environmental Engineering
Provides a series of activities that explore the field of environmental engineering. Through completion of the course, students will gain fundamental experiences with the skills, knowledge, and attitudes needed to solve the complex environmental problems needing solutions from today’s environmental engineers.

Credits: 1.0
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Fall

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: 4.0
Lec-Rec-Lab: (0-3-2)
Semesters Offered: Fall, Spring
Pre-Requisite(s): ENG 2120 or MEEM 2150

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: (0-2-3)
Semesters Offered: Fall, Spring
Pre-Requisite(s): ENG 2120 or MEEM 2150

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
Pre-Requisite(s): 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, Summer
Restrictions: May not be enrolled in one of the following Class(es): Freshman

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: (3-0-0)
Semesters Offered: Fall, Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman

CE 3401 - Transportation Engineering
Introduction to transportation in the United States, highway types and systems, principles of route location, vehicle characteristics, highway geometrics 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
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore

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
Pre-Requisite(s): (MA 2150 or MA 2160) 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 analyses. 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
Pre-Requisite(s): (MA 2150 or MA 2160) 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 used for water and wastewater treatment, solid waste management, air pollution control, and analysis of quality of surface water, air, and groundwater.

Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring, Summer
Pre-Requisite(s): (MA 2150 or MA 2160) and (CH 1100 or CH 1110)
CE 3610 - Hydrology
Components of the hydrologic cycle and their interactions. Emphasizes rainfall-runoff relationships as applied to civil engineering. Also includes probability concepts, frequency analysis, and hydrologic flood routing.
Credits: 2.0
Lec-Rec-Lab: (2-0-0)
Semesters Offered: Fall, Spring
Pre-Requisite(s): CE 3600 and (MA 3710 or CE 3502)

CE 3620 - Water Resources Engineering
Introduction to hydrologic engineering, including rainfall-runoff modeling and hydrologic frequency analysis. Analysis and design of hydraulic systems such as pipe networks and storm water management systems. Computational, field, and experimental laboratory sessions reinforce lectures and provide hands-on learning opportunities.
Credits: 4.0
Lec-Rec-Lab: (3-0-2)
Semesters Offered: Fall, Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): ENG 3200 and (MA 3710(C) or CE 3502(C))

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 stress 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
Pre-Requisite(s): GE 2000 and (ENG 2120 or ENG 2150) and (ENG 3200 or ENG 3507)

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
Pre-Requisite(s): CE 3201

CE 4211 - Reinforced Concrete Design
Design of reinforced concrete two-way slab systems and elements of continuous frames, including beams for combined torsion and shear, and short and slender columns. Isolated, combined, and continuous footings will also be considered.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): 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 combined 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
Pre-Requisite(s): CE 3201

CE 4231 - Timber and Masonry Design
Introduction to timber design and wood as a structural engineering material. Includes beams, columns, and nailed and bolted connections. Introduction to masonry materials and design. Includes flexural design, pilasters, and shear wall design.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): 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: (2-0-2)
Semesters Offered: Fall
Pre-Requisite(s): CE 3331 and CE 3332

CE 4335 - Building Construction
Introduction to means, methods, materials, components and processes used to construct commercial, industrial and residential buildings in the U.S. Focuses on terminology and practical applications common to the construction industry through visual presentations construction drawing interpretation and industry practitioners.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Summer
Pre-Requisite(s): CE 3101

CE 4338 - Computer Based Project Management
Integrate information from scheduling and estimating computer programs to use as tools to monitor, control, and manage projects. The course will develop a student’s ability to use computer tools to interconnect the traditionally isolated project cost and schedule information.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Summer
Pre-Requisite(s): CE 3332
CE 4401 - Pavement Design
Analysis, behavior, performance, and structural design of highway pavements. Introduces pavement types and performance concepts, highway traffic and subgrade 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
Pre-Requisite(s): 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, Summer
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore

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/dissolution, redox chemistry, diffusion, mass transfer, and applications to engineering design. Laboratory experiences illustrate principles and modern measurement.
Credits: 4.0
Lec-Rec-Lab: (0-3-3)
Semesters Offered: Fall
Pre-Requisite(s): (CE 3501 or CE 3503) and CE 3502 and CH 3500(C)

CE 4504 - Air Quality Engineering and Science
Overview of air quality regulation in the U.S. and world, including basic concepts of atmospheric chemistry and transport; fugitive, point, and area emissions; principles and tradeoffs of operation and design of air pollution control systems; and application of air quality models.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): CE 3501 or CE 3503

CE 4505 - Surface Water Quality Engineering
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: (0-2-3)
Semesters Offered: Fall
Pre-Requisite(s): CE 3501 or CE 3503
CE 4506 - Application of Environmental Regulations and Pollution Prevention to Engineering Practice
Study of the federal and state regulations and policy that govern management of solid and hazardous waste and how these regulations are incorporated into engineering practice. Other topics include sustainability and eco-business innovation, brownfield redevelopment, risk assessment, and engineering ethics.

Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): CE 3501 or CE 3503

CE 4507 - Water Distribution and Wastewater Collection Design
Application of basic principles in civil and environmental engineering to the analysis and design of water distribution systems, wastewater collection systems, air distribution and collection systems, and their appurtenances.

Credits: 3.0
Lec-Rec-Lab: (2-0-1)
Semesters Offered: Spring
Pre-Requisite(s): (CE 3620 or CE 3600) and (CE 3501 or CE 3503)

CE 4508 - Water and Wastewater Treatment
Principles of physical, chemical and biological processes employed in water and wastewater treatment. Design of selected individual units within water and wastewater treatment systems.

Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Pre-Requisite(s): CE 3620 and (CE 3501 or CE 3503)

CE 4509 - Environmental Process & Simulation
Provides a rigorous hands-on introduction to process control, laboratory and pilot-plant experimentation focused on physical, chemical and biological treatment systems used in environmental engineering.

Credits: 2.0
Lec-Rec-Lab: (0-0-5)
Semesters Offered: Spring
Pre-Requisite(s): CE 4508 and (CE 3501 or CE 3503) and (CE 3620 or CE 3600) and CE 4501

CE 4510 - Baccalaureate Thesis
Independent baccalaureate research project performed under the supervision of one or more faculty.

Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring
Restrictions: Permission of instructor required; May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior
CE 4515 - Atmospheric Chemistry
Study of the photochemical processes governing the composition of the troposphere and stratosphere, with application to air pollution and climate change. Covers radical chain reaction cycles, heterogeneous chemistry, atmospheric radiative transfer, and measurement techniques for atmospheric gases.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Level(s): Graduate; Must be enrolled in one of the following Class(ies): Senior
Pre-Requisite(s): (CE 4504 and CE 4501) or (CH 3510 and CH 3520(C))

CE 4610 - Civil and Environmental Engineering Systems Analysis
Introduction to operations research with applications to civil and environmental engineering. Decision analysis and optimization techniques, including linear programming, nonlinear programming, and dynamic programming. Computer-based solutions of design problems in various civil engineering specialty areas are considered.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall - Offered alternate years beginning with the 2005-2006 academic year
Pre-Requisite(s): MA 2150 or MA 2160

CE 4620 - Open Channel Flow
Analysis of open channel systems, including natural channels, designed channels, flow transitions, non-uniform flow, and unsteady flow.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Pre-Requisite(s): CE 3620

CE 4630 - Hydraulic Structures
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)
Semesters Offered: Spring
Pre-Requisite(s): CE 3620 or CE 3600

CE 4820 - Foundation Engineering
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)
Semesters Offered: Fall
Pre-Requisite(s): CE 3201 and CE 3810
CE 4830 - Geosynthetics Engineering
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)
Semesters Offered: Spring
Pre-Requisite(s): CE 3810

CE 4840 - Aggregate Engineering & Utilization
Introduction into various aspects of aggregate exploration, production, and utilization. Topics covered include geophysical techniques for aggregate exploration, environmental issues in aggregate production including surface and underground mining concepts, crushing and sizing and aggregate utilization in Civil Engineering applications.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: On Demand
Pre-Requisite(s): CE 3101

CE 4900 - Engineering Design Project I
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. (Senior project ready as defined by major substitutes for prerequisites)
Credits: 3.0
Lec-Rec-Lab: (0-2-3)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior

CE 4905 - Engineering Design Project
An engineering design project related to civil and environmental engineering. Not available to students who have taken CE4900 or CE4910. (Senior project ready as defined by major substitutes for prerequisites)
Credits: 3.0
Lec-Rec-Lab: (0-2-3)
Semesters Offered: Fall, Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior

CE 4910 - Engineering Design Project II
Continuation of CE4900. Not available to students who have taken CE4905. Students must complete both CE4900 and CE4910 to get credit for either one. (Senior project ready as defined by major substitutes for prerequisites)
Credits: 3.0
Lec-Rec-Lab: (0-2-3)
Semesters Offered: Spring
Pre-Requisite(s): CE 4900

CE 4920 - Civil Engineering Independent Study
Approved research or design project in civil engineering, originating with an individual student or assigned by the instructor.
Credits: variable to 3.0; Repeatable to a Max of 3
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of instructor required; May not be enrolled in one of the following Class(es): Freshman, Sophomore
CE 4930 - Environmental Engineering Independent Study
Approved research or design project in environmental engineering, originating with an individual student or assigned by the instructor.
Credits: variable to 3.0; Repeatable to a Max of 3
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of instructor required; May not be enrolled in one of the following Class(es): Freshman, Sophomore

CE 4990 - Special Topics in Civil and Environmental Engineering
Topics of special interest in civil or environmental engineering.
Credits: variable to 3.0; Repeatable to a Max of 9
Semesters Offered: Fall, Spring

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Civil Engineering Technology

CET 1141 - Fundamentals of Cemented Aggregate Mixtures
Introduction to the fundamentals of aggregates, asphalt and portland cement concrete construction materials, including physical properties, testing, and placing. Students may qualify for certification as an ACI Level I Concrete Technician and as an MDOT Certified Aggregate Technician.
Credits: 4.0
Lec-Rec-Lab: (0-3-3)
Semesters Offered: Fall

CET 2251 - Soils in Construction
Introduces students to the fundamentals of soils engineering technology, including soil composition, classification, testing, foundations, and density measurement.
Credits: 4.0
Lec-Rec-Lab: (0-3-3)
Semesters Offered: Spring
Pre-Requisite(s): MET 2120

CET 2252 - Water and Wastewater Technology
Introduction to hydraulics and hydrology. Topics include closed piping systems, pumps, open channel flow, and quantities of water and wastewater.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Class(es): Sophomore, Junior, Senior
Pre-Requisite(s): MET 2120

CET 3250 - Structural Analysis and Design
Elastic theory analysis and design of steel structural components, including tension, compression, truss frames, flexural beams, and connections. Includes an introduction to reinforced concrete structures and timber. All work is according to current applicable code manuals. Design projects include computer applications.
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
Pre-Requisite(s): MET 2120
CET 4200 - Construction Contract Administration
A study of construction documents, the project manual, report requirements, agreements, change orders, and other administrative functions in building construction.
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, Sophomore, Junior
Pre-Requisite(s): CMG 2265 and BA 2500

Chemistry

CH 0011 - Development of Chemistry Skills
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: 0.0; May be repeated
Semesters Offered: Fall, Spring, Summer

CH 1000 - Preparatory Chemistry
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.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Summer
Co-Requisite(s): CH 0011

CH 1100 - General Chemistry
Introduces the foundations of chemistry, including electronic structure of atoms and molecules, intermolecular forces, states of matter, chemical reactions, organic chemistry, chemical equilibria, kinetics, and acid-base chemistry. Includes laboratory component that emphasizes lecture concepts. Not recommended for students in programs requiring one year of first-year chemistry.
Credits: 4.0
Lec-Rec-Lab: (3-0-3)
Semesters Offered: Fall, Spring, Summer

CH 1110 - University Chemistry I
Introduces experimental and theoretical foundations of chemistry, including electronic structure of atoms and molecules, intermolecular forces, states of matter, chemical reactions, gas laws, thermochemistry, and chemical kinetics. Not recommended for students in programs requiring only one semester of first-year chemistry.
Credits: 4.0
Lec-Rec-Lab: (3-1-0)
Semesters Offered: Fall, Spring, Summer
Co-Requisite(s): CH 1111

CH 1111 - University Chemistry Lab I
Laboratory to accompany CH1110.
Credits: 1.0
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Fall, Spring, Summer
Co-Requisite(s): CH 1110
CH 1120 - University Chemistry II
A continuation of CH 1110. Introduces more complex concepts in chemistry, including kinetics, chemical equilibria, acid-base equilibria, thermodynamics, electrochemistry, and chemical analysis. Additional topics may include chemistry of the metals and non-metals, biochemical systems, and nuclear chemistry. Includes laboratory component that emphasizes lecture concepts.
Credits: 4.0
Lec-Rec-Lab: (3-0-3)
Semesters Offered: Fall, Spring, Summer
Pre-Requisite(s): CH 1100 or (CH 1110 and CH 1111)

CH 1130 - Orientation
Discussion of career opportunities in chemistry; introduction to the ChemSci computer network. Required for all entering chemistry majors.
Credits: 1.0
Lec-Rec-Lab: (1-0-0)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Major(s): Chemistry

CH 1140 - Introduction to Organic, Inorganic and Biochemistry
Introduces the principles of organic, inorganic, and biochemistry. Topics include nomenclature, chemical bonding, oxidation reduction, properties of gases and liquids, and nuclear chemistry. Chemistry majors may not include this course as part of the credit requirements for graduation.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Pre-Requisite(s): CH 1100 or (CH 1110 and CH 1111)

CH 1800 - Biochemistry Orientation
Introduction to current research and career opportunities in biochemistry with emphasis on the interdisciplinary nature of the field.
Credits: 1.0
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following College(s): College of Sciences & Arts

CH 2212 - Quantitative Analysis
Measurements and calculations relevant to volumetric and gravimetric analysis as well as electrochemistry and separations. Error analysis and statistical treatment of data. In the laboratory, introduces classical and contemporary techniques that require high quality measurements.
Credits: 5.0
Lec-Rec-Lab: (3-0-6)
Semesters Offered: Spring
Pre-Requisite(s): CH 1120

CH 2400 - Principles of Organic Chemistry
Discusses properties and reactions of various functional groups using reaction mechanisms as a unifying theme. Emphasizes practical applications using industrial, environmental, current events, and biological/medicinal examples. Not open to students whose programs require CH2410.
Credits: 4.0
Lec-Rec-Lab: (4-0-0)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Major(s): Biological Sciences, Chemistry
Pre-Requisite(s): CH 1120
CH 2410 - Organic Chemistry I
A study of the chemistry of carbon compounds. Review of hybrid orbitals, covalent bonding, and resonance. Introduction to nomenclature, stereochemistry, infrared and nuclear magnetic resonance spectroscopy, functional group chemistry based on reaction mechanisms, and multi-step synthesis.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Summer
Pre-Requisite(s): CH 1120

CH 2411 - Organic Chemistry Lab I
Laboratory to accompany CH2410 and CH2400.
Credits: 1.0
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Fall, Summer
Pre-Requisite(s): (CH 2410(C) or CH 2400(C)) and CH 1120

CH 2420 - Organic Chemistry II
Continuation of CH2410. Covers more functional group chemistry based on reaction mechanisms; more involved multi-step synthesis; introduction to carbohydrates, amino acids, proteins, nucleic acids; and topics of specialized interest.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring, Summer
Pre-Requisite(s): CH 2410 or CH 2400

CH 2421 - Organic Chemistry Lab II
Laboratory to accompany CH2420.
Credits: 2.0
Lec-Rec-Lab: (0-0-4)
Semesters Offered: Spring, Summer
Pre-Requisite(s): CH 2411 and CH 2420(C)

CH 3020 - Laboratory Teaching Internship
Requires teaching a section of undergraduate laboratory under professional supervision. Emphasizes communicating good laboratory practice and technique to beginning students as well as maintaining a safe working environment. Includes safety training and teaching orientation. Required for certification in the ACS chemistry/education option.
Credits: 2.0
Lec-Rec-Lab: (0-0-4)
Semesters Offered: Fall, Spring
Restrictions: Permission of instructor required; May not be enrolled in one of the following Class(es): Freshman, Sophomore

CH 3500 - Physical Chemistry for Environmental and Life Sciences
Equilibrium thermodynamics, chemical kinetics, transport properties, gas laws, and phase equilibria with an emphasis on solution behavior and applications to molecules important in the environmental and life sciences.
Credits: 2.0
Lec-Rec-Lab: (2-0-0)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Major(s): Chemical Engineering, Chemistry
Pre-Requisite(s): (CH 1100 or CH 1110) and (CH 1120 or CH 1140) and (MA 2150 or MA 2160)
CH 3501 - Physical Chemistry for Environmental and Life Sciences
Equilibrium thermodynamics, chemical kinetics, transport properties, gas laws, and phase equilibria with an emphasis on solution behavior and applications to molecules important in the environmental and life sciences. Course offered first half of spring semester.
Credits: 2.0
Lec-Rec-Lab: (4-0-0)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Major(s): Chemistry, Chemical Engineering
Pre-Requisite(s): (CH 1100 or CH 1110) and (CH 1120 or CH 1140) and (MA 2150 or MA 2160)

CH 3510 - Physical Chemistry I - Thermodynamics, Equilibrium and Kinetics
Ideal and non-ideal gas laws, the kinetic theory of gases, equations of state, liquid-vapor equilibrium, the laws of thermodynamics, solid-liquid-vapor equilibria, the chemical potential, chemical equilibrium, electrochemistry, the phase rule, phase diagrams, and chemical kinetics.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring
Pre-Requisite(s): CH 1112 and PH 2200(C) and (MA 2150 or MA 2160)

CH 3511 - Physical Chemistry Lab I
Laboratory to supplement CH3510.
Credits: 2.0
Lec-Rec-Lab: (0-0-4)
Semesters Offered: Fall, Spring
Pre-Requisite(s): CH 3510(C)

CH 3520 - Physical Chemistry II - Molecular Structure
Continuation of CH3510. Covers solid-state chemistry, surface chemistry, atomic and molecular spectroscopy and structure, chemical applications of group theory, valence, the periodic table, elements of quantum mechanics, and statistical thermodynamics.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Pre-Requisite(s): CH 1120 and PH 2200(C) and (MA 3150 or MA 3160)

CH 3521 - Physical Chemistry Lab II
Laboratory to supplement CH3520.
Credits: 2.0
Lec-Rec-Lab: (0-0-4)
Semesters Offered: Spring
Pre-Requisite(s): CH 3520(C)

CH 3540 - Biophysical Chemistry
Examines fundamental physical principles underlying complex biological systems in order to understand the interactions and behaviors found in biological, biochemical, and physical systems. Topics include macromolecules in aqueous environments, spectroscopy and structure determination, kinetics, membranes, and transport phenomena.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Pre-Requisite(s): CH 1120 and PH 2200 and (MA 3150 or MA 3160) and (BL 1020 or BL 1040)
CH 3541 - Biophysical Chemistry Laboratory
Examines the physical methods employed in the study of biological systems, including structure determination, spectroscopy, microscopy, imaging, and modeling. The core objective is application of the fundamentals developed in the Biophysical Chemistry course to systems of biological relevance.
**Credits:** 2.0
**Lec-Rec-Lab:** (0-0-4)
**Semesters Offered:** Spring
**Co-Requisite(s):** CH 3540

CH 4110 - Pharmaceutical Chemistry I: Drug Action
Focuses on structural and mechanistic approaches to pharmaceuticals and drug action. General principles of absorption, distribution, action, metabolism and toxicity of drugs will be presented followed by action of drug classes such as antibiotics, cardiovascular, and anti-inflammatory drugs.
**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
**Pre-Requisite(s):** CH 4710 or BL 4010

CH 4120 - Pharmaceutical Chemistry II: Drug Design
Focuses on the important concepts in the design and synthesis of drugs. Rational basis for drug design including synthetic, computational and biochemical concepts will be discussed. Topics include structure-activity relationships, synthesis and reaction mechanism, and case studies of drugs.
**Credits:** 3.0
**Lec-Rec-Lab:** (3-0-0)
**Semesters Offered:** Fall
**Restrictions:** May not be enrolled in one of the following Class(es): Freshman
**Pre-Requisite(s):** CH 4110

CH 4190 - Current Topics in Pharmaceutical Chemistry
Discussion of recent topics in pharmaceutical chemistry.
**Credits:** variable to 3.0; Repeatable to a Max of 12
**Semesters Offered:** On Demand
**Restrictions:** Permission of instructor required; May not be enrolled in one of the following Class(es): Freshman

CH 4210 - Instrumental Analysis
The lecture portion of CH4212; not open to undergraduate chemistry majors.
**Credits:** 3.0
**Lec-Rec-Lab:** (3-0-0)
**Semesters Offered:** Fall
**Pre-Requisite(s):** CH 2212 and CH 3510(C) and CH 3511(C)

CH 4212 - Instrumental Analysis
Chemical instrumentation applied to organic and inorganic analysis with emphasis on chromatography and spectroscopy.
**Credits:** 5.0
**Lec-Rec-Lab:** (3-0-6)
**Semesters Offered:** Fall
**Pre-Requisite(s):** CH 2212 and CH 3510(C) and CH 3511(C)
CH 4222 - Introduction to Quantitative and Instrumental Analysis
Measurements and calculations relevant to volumetric and gravimetric techniques. Error analysis and statistical treatment of data. Basic chemical instrumentation applied to organic and inorganic analysis with emphasis on chromatography and spectroscopy.
Credits: 5.0
Lec-Rec-Lab: (3-0-6)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Major(s): Chemistry; May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): CH 1120 and CH 3510(C) and CH 3511(C)

CH 4272 - Process Analytical Chemistry
Hands-on introduction to the application of modern analytical chemistry in the process industries. Presents the fundamentals, use, and limitations of instruments used for process analytical measurements as well as safety regulations and hazard classifications. Emphasizes theory and practical aspects of process sampling.
Credits: 4.0
Lec-Rec-Lab: (0-2-6)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): CH 3511

CH 4290 - Current Topics in Analytical Chemistry
Discussion of recent topics in analytical chemistry.
Credits: variable to 3.0; Repeatable to a Max of 12
Semesters Offered: On Demand
Restrictions: Permission of instructor required; May not be enrolled in one of the following Class(es): Freshman

CH 4292 - Independent Study in Analytical Chemistry
An undergraduate research experience in analytical chemistry. Students select a literature and/or laboratory problem and write a summary report.
Credits: variable to 3.0; Repeatable to a Max of 9
Semesters Offered: On Demand
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore

CH 4310 - Inorganic Chemistry I
Study of the bonding, physical and chemical properties, structure and reactions of the chemical elements and their compounds. Examples will include both transition metals and main group elements.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Pre-Requisite(s): CH 3520

CH 4311 - Inorganic Chemistry Laboratory
Laboratory preparations (selected inorganic and organometallic compounds) that illustrate appropriate experimental techniques for syntheses, manipulations, and methods of analyses.
Credits: 2.0
Lec-Rec-Lab: (0-0-4)
Semesters Offered: Fall
Pre-Requisite(s): CH 4310(C)
CH 4320 - Inorganic Chemistry II
Continuation of CH4310. A survey course that continues the study of the general principles of inorganic chemistry and the chemistry of the elements and their compounds.

Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Pre-Requisite(s): CH 4310

CH 4390 - Current Topics in Inorganic Chemistry
Discussion of recent topics in inorganic chemistry.

Credits: variable to 3.0; Repeatable to a Max of 12
Semesters Offered: On Demand
Restrictions: Permission of instructor required; May not be enrolled in one of the following Class(es): Freshman

CH 4412 - Spectroscopy of Organic Chemistry
Emphasizes use of spectral data interpretation to determine structures of organic compounds. Discusses proton and carbon nuclear magnetic resonance (including two-dimensional techniques, COSY, HETCOR, etc.), mass spectrometry, infrared spectrophotometry. Includes use of modern software, including NMR spectromodelling, data handling and presentation, and spectral database packages.

Credits: 3.0
Lec-Rec-Lab: (2-0-3)
Semesters Offered: Spring
Pre-Requisite(s): CH 2420

CH 4430 - Intermediate Organic Chemistry
Develop the chemical intuition necessary for advanced work in organic chemistry. Emphasizes reaction mechanisms and why reactions occur. Topics include heteraromatic chemistry, curved-arrow formalism and multi-step reactions, molecular orbitals and symmetry-controlled reactions, Hammet equation and structure-activity relationships, substitution reactions and carbonyl reactions.

Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Pre-Requisite(s): CH 2420

CH 4490 - Current Topics in Organic Chemistry
Discussion of recent topics in organic chemistry.

Credits: variable to 3.0; Repeatable to a Max of 12
Semesters Offered: On Demand
Restrictions: Permission of instructor required; May not be enrolled in one of the following Class(es): Freshman

CH 4510 - Intermediate Physical Chemistry
Discussion of selected topics in molecular orbital theory, atomic and molecular spectroscopy, group theory, thermodynamics, statistical mechanics, the solid state, and other topics for students with previous coursework in physical chemistry.

Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Pre-Requisite(s): CH 3520
CH 4515 - Atmospheric Chemistry
Study of the photochemical processes governing the composition of the troposphere and stratosphere, with application to air pollution and climate change. Covers radical chain reaction cycles, heterogeneous chemistry, atmospheric radiative transfer, and measurement techniques for atmospheric gases.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Level(s): Graduate; Must be enrolled in one of the following Class(es): Senior
Pre-Requisite(s): (CH 3510 and CH 3520(C)) or (CE 4501 and CE 4504)

CH 4560 - Computational Chemistry
Focuses on the theory and method of modern computational techniques applied to the study of molecular properties and reactivity through lecture and computer projects. Covers classical mechanical as well as quantum mechanical approaches.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Pre-Requisite(s): CH 3520

CH 4590 - Current Topics in Physical Chemistry
Discussion of recent topics in physical chemistry.
Credits: variable to 3.0; Repeatable to a Max of 12
Semesters Offered: On Demand
Restrictions: Permission of instructor required; May not be enrolled in one of the following Class(es): Freshman

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, rubbery elasticity, rheology and polymer processing. Applications discussed include coatings, adhesives, and composites.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Pre-Requisite(s): CH 1120

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 for measuring and predicting the path of degradation and stabilization.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring
Pre-Requisite(s): CH 2420 or CH 2400

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: Fall
Pre-Requisite(s): CH 4610(C) or CM 4610(C)
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: Spring
Pre-Requisite(s): CH 4620(C)

CH 4690 - Current Topics in Polymer Chemistry
Discussion of current topics in polymer chemistry.
Credits: variable to 3.0; Repeatable to a Max of 12
Semesters Offered: On Demand
Restrictions: Permission of instructor required; May not be enrolled in one of the following Class(es): Freshman

CH 4710 - Biomolecular Chemistry I
Examines chemical concepts underlying biomolecules and bioprocesses and interconnections between biology and chemistry. Bioorganic mechanisms and biophysical concepts in biochemistry are emphasized. Topics include biomolecules including proteins and nucleic acids and bioprocesses including catalysis and gene action.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Pre-Requisite(s): CH 2420

CH 4720 - Biomolecular Chemistry II
Focuses on structural and chemical logic of bioprocesses with emphasis on bioorganic mechanisms and the interconnections between biology and chemistry. Topics include metabolic pathways, membrane biophysics, ion-channels, cell communication, transcriptional control and molecular biology.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Restrictions: Permission of instructor required; May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): CH 4710 or BL 4010

CH 4790 - Current Topics in Biochemistry
Discussion of recent topics in biochemistry.
Credits: variable to 3.0; Repeatable to a Max of 12
Semesters Offered: On Demand
Restrictions: Permission of instructor required; May not be enrolled in one of the following Class(es): Freshman

CH 4800 - Current Topics in Undergraduate Chemistry
Covers chemistry topics not included in regular courses. Topics may include designing organic syntheses, heterogeneous catalysis, homogeneous catalysis, solid-state chemistry, and heterocyclic chemistry.
Credits: variable to 3.0; Repeatable to a Max of 12
Semesters Offered: On Demand
CH 4810 - Design and Operation of a High School Chemistry Lab
Hands-on experience in the operation of a high school chemistry laboratory. Includes the design and preparation of experiments and demonstrations, setting up and maintaining a chemical storeroom, chemical waste disposal, and safety issues. Required for certification in the ACS chemistry/education concentration.
Credits: 2.0
Lec-Rec-Lab: (0-0-6)
Semesters Offered: Spring
Pre-Requisite(s): (CH 2420 and CH 2421) or (CH 2400 and CH 2411) and CH 3020

CH 4900 - Senior Seminar in Chemistry I
Discussion of various topics relevant for professional development.
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, Sophomore, Junior

CH 4910 - Senior Seminar in Chemistry II
Discussion of various topics relevant for professional development. Includes preparation of abstracts and reports. Presentation of results of undergraduate research project or assigned library topic in written and oral form.
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, Sophomore, Junior

CH 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 6.0; Repeatable to a Max of 12
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of department required

CH 4995 - Undergraduate Research in Biochem
Undergraduate research experience in Biochemistry where students work in independent research project under the direction of a faculty advisor. Credits: variable to 6.0; Repeatable to a Max of 12
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of department required

Chemical Engineering

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, Summer
Pre-Requisite(s): CH 1110 or CH 1100
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 Simulations software.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring, Summer
Pre-Requisite(s): CM 2110

CM 2200 - Intro Minerals and Materials
Fundamentals of minerals processing, raw materials production, and extractive metallurgy, including primary metals production.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall

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, Spring
Pre-Requisite(s): CM 2120 and PH 2100 and (MA 3520 or MA 3521 or MA 3530 or MA 3560)

CM 3120 - Transport/Unit Operations 2
Mass transfer fundamentals applied to unit operations. Topics include Fick's Law, continuity equation with reaction and mass transfer co-efficients. Transient heat transfer and numerical solution are covered. Applications include absorption, distillation, extraction, adsorption, and membrane separations.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Pre-Requisite(s): CM 3110 and (MA 3520 or MA 3521 or MA 3530 or MA 3560)

CM 3215 - Fundamentals of Chemical Engineering Laboratory
This course will be an introduction to basic laboratory methods and instrumentation used in the measurement of fluid flow, heat transfer, and mass transfer. Topics to be covered include methods of statistical data analysis, experimental design, principles of measurement and instrumentation, and presentation of data.
Credits: 2.0
Lec-Rec-Lab: (1-0-3)
Semesters Offered: Fall, Spring
Pre-Requisite(s): CM 2120 and (MA 3520 or MA 3521 or MA 3530 or MA 3560)

CM 3220 - Chem Engg Thermodynamics
Calculation of thermodynamic properties of homogeneous fluids and phase equilibria. Includes pertinent topics in statistical or molecular thermodynamics.
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): Freshman, Sophomore
Pre-Requisite(s): CH 3510 and (MA 3520 or MA 3521 or MA 3530 or MA 3560)
CM 3230 - Thermodynamics for Chemical Engineers
First and second law applied to closed and open systems. Topics include energy conversion, power cycles, entropy and enthalpy calculations on engineering systems; property estimation for non-ideal vapors, liquids, and other substances, non-ideal multicomponent equilibria, chemical reaction equilibria.
**Credits:** 4.0
**Lec-Rec-Lab:** (4-0-0)
**Semesters Offered:** Fall, Spring
**Pre-Requisite(s):** CH 3510 and (MA 3150 or MA 3160) and (MA 3520(C) or MA 3521(C) or MA 3530(C) or MA 3560(C))

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:** (2-0-2)
**Semesters Offered:** Spring
**Pre-Requisite(s):** (MA 3520 or MA 3521 or MA 3530 or MA 3560) 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, memo and formal reports, research citations, and job-seeking requirements. Emphasizes organization, support, coherence, usefulness, ethics, and professionalism.
**Credits:** 3.0
**Lec-Rec-Lab:** (3-0-0)
**Semesters Offered:** Fall, Spring, Summer
**Restrictions:** May not be enrolled in one of the following Class(es): Freshman, Sophomore
**Pre-Requisite(s):** UN 2001 and UN 2002

CM 3420 - Chemical-Related Manufacturing
Course includes overviews of several different manufacturing processes (chemical, paper, consumer, steel products). Lecture sessions are complemented by several trips to large industrial facilities. Students receive technical and/or business objectives that must be met through discovery during the plant tours.
**Credits:** 2.0
**Lec-Rec-Lab:** (1-0-1)
**Semesters Offered:** Fall
**Restrictions:** Must be enrolled in one of the following Major(s): Chemical Engineering
**Pre-Requisite(s):** CM 2120(C)

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
**Pre-Requisite(s):** CM 3110 and (CM 3220 or CM 3230) and (MA 3520 or MA 3521 or MA 3530 or MA 3560)
CM 3810 - Intro to Unit Operations
Quantitative and qualitative design and analysis of chemical engineering unit operations: fluid flow (flow in pipes, pumps, flow measurement, fluidization, thickening); heat transfer (condensers, heat exchangers, evaporators); and separation processes (distillation, absorption/desorption, extraction); drying and bulk transport of solids.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): CH 1100 or CH 1110

CM 3820 - Sampling and Data Analysis
Solids sampling theory, practice, and instrumentation for process streams. Statistics/probability as they apply to representative samples from bulklots. Minimization of errors, proper design of sample collection apparatus, statistical design and analysis, and measurements of temperature, flow rate will be covered.
Credits: 3.0
Lec-Rec-Lab: (2-0-1)
Semesters Offered: Spring - Offered alternate years beginning with the 2006-2007 academic year

CM 3974 - Fuel Cell Fundamentals
This course provides an introduction to fuel cells and fuel cell systems. Topics include an overview of fuel-cell construction, fuel-cell chemistry, fuel-cell losses and efficiency, and integrating fuel cells into vehicles.
Credits: 1.0
Lec-Rec-Lab: (1-0-0)
Semesters Offered: Fall
Pre-Requisite(s): CH 1100 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 3.0; Repeatable to a Max of 9
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of instructor required

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: Fall
Pre-Requisite(s): CM 3120 and (CM 3220 or CM 3230) and CM 3410 and CM 3510 and CM 4310(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
Pre-Requisite(s): CM 4110
CM 4125 - Bioprocess Engineering Laboratory
An integrated biological process laboratory experience, including fermentation with downstream bioseparation, for the production of a purified product of potential commercial interest. Features process measurement-analysis-improvement, metabolic pathway analysis, quality assurance, and safety.
Credits: 1.0
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Spring - Offered alternate years beginning with the 2005-2006 academic year
Pre-Requisite(s): CM 4710(C) or BL 3210 or BL 3310

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: May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior
Pre-Requisite(s): CM 3120 and (CM 3220 or CM 3230)

CM 4500 - Particle Technology
Fundamentals of particle processing, characterization, and separation. Topics include fine particle synthesis; mineral processing; automobile recycling; contaminated soils; recyclable materials such as batteries and tires; and sludges. Also covers zeta potential, particulate surface chemistry, flocculation, and dispersion.
Credits: 4.0
Lec-Rec-Lab: (3-0-3)
Semesters Offered: Spring - Offered alternate years beginning with the 2005-2006 academic year

CM 4550 - Industrial Chemical Production
Integration of chemical engineering and chemistry as practiced in modern industry. Engineering of chemical reactions and processes for commodity chemicals, petroleum-based fuels, petrochemicals, intermediates, specialty chemicals, pharmaceuticals, and engineered materials. Environmental strategies for waste minimization and pollution prevention.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: On Demand
Pre-Requisite(s): (CH 2400 or CH 2410) and CM 3510(C)

CM 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, rubbery elasticity, rheology and polymer processing. Applications discussed include coatings, adhesives, and composites.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Pre-Requisite(s): CH 1120
CM 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, Spring
Pre-Requisite(s): CH 2420 or CH 2400

CM 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: Fall
Pre-Requisite(s): CM 4610(C)

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: Spring
Pre-Requisite(s): CM 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: Spring
Pre-Requisite(s): (CM 3110 or MEEM 3210 or ENG 3200 or MY 3110 or CE 3600) and (MA 3520 or MA 3521 or MA 3530 or MA 3560)

CM 4655 - Polymer Rheology Laboratory
Basic techniques for acquisition of shear rheological data in torsional shear (cone-and-plate and parallel-plate) and capillary shear will be taught. Also covered will be sample preparation and handling techniques for polymers.
Credits: 1.0
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Fall
Restrictions: Permission of instructor required; May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): CM 4610(C) or CH 4610(C) or CM 4650(C)
**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, industrial application, genetic engineering concepts, and applications.  
**Credits:** 3.0  
**Lec-Rec-Lab:** (3-0-0)  
**Semesters Offered:** Fall - Offered alternate years beginning with the 2005-2006 academic year  
**Restrictions:** May not be enrolled in one of the following Class(es): Freshman, Sophomore  
**Pre-Requisite(s):** CM 3110(C)

**CM 4740 - Hydrometallurgy/Pyrometallurgy**  
Extracting metal from ores by aqueous chemical techniques. The unit processes and unit operations in the dissolution, solubility, aqueous chemistry, concentrating and purifying metal-bearing solutions, and recovery of metals by precipitation and electrolytic processing will be discussed.  
**Credits:** 4.0  
**Lec-Rec-Lab:** (4-0-0)  
**Semesters Offered:** Spring - Offered alternate years beginning with the 2004-2005 academic year  
**Restrictions:** May not be enrolled in one of the following Class(es): Freshman, Sophomore  
**Pre-Requisite(s):** CH 1120

**CM 4850 - CM Process Analysis & Design 1**  
Technical and economic evaluation of chemical processes and operations. Applies material and energy balances, flowsheets, energy utilization, and optimization to process 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-Rec-Lab:** (2-0-0)  
**Semesters Offered:** Fall  
**Pre-Requisite(s):** CM 3120 and (CM 3220 or CM 3230) and CM 3410

**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  
**Pre-Requisite(s):** 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-Rec-Lab:** (2-0-0)  
**Semesters Offered:** Spring  
**Pre-Requisite(s):** CM 4850 and CM 4851

**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
Pre-Requisite(s): CM 4860(C)

**CM 4900 - Interdisciplinary Design 1**
Focuses on an interdisciplinary chemical engineering design project. (Senior project ready as defined by major substitutes for prerequisites)

**Credits:** 3.0
**Lec-Rec-Lab:** (0-1-6)
**Semesters Offered:** Fall

**Restrictions:** May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior

**Pre-Requisite(s):** CM 3120 and (CM 3220 or CM 3230) and CM 3310 and CM 3510

**CM 4910 - Interdisciplinary Design 2**
Focuses on an interdisciplinary chemical engineering design project. (Senior project ready as defined by major substitutes for prerequisites)

**Credits:** 3.0
**Lec-Rec-Lab:** (0-1-6)
**Semesters Offered:** Spring

**Restrictions:** May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior

**Pre-Requisite(s):** CM 3120 and (CM 3220 or CM 3230) and CM 3310 and CM 3510

**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:** (2-0-3)
**Semesters Offered:** On Demand

**Pre-Requisite(s):** CM 3310

**CM 4990 - Special 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; Repeatable to a Max of 12
**Semesters Offered:** On Demand

**Restrictions:** Permission of instructor required
Construction Management

CMG 1001 - Orientation to Construction Management
Introduction to the profession of Construction Management through guest speakers and focused discussion. Students will research aspects of the profession and make oral presentations.

Credits: 1.0
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Spring

CMG 1111 - Architectural CAD
Introduction to architectural drafting using CAD. Topics include creating, editing, dimensioning and annotating structural features (walls, floors, ceilings, roofs, doors, windows, stairs) in buildings. Types of drawings include floor plans, elevations, sections and details.

Credits: 2.0
Lec-Rec-Lab: (0-1-2)
Semesters Offered: Spring
Pre-Requisite(s): TE 1110

CMG 2265 - Construction Quantity Survey
An introduction to the interpretation of construction drawings to perform quantity take-offs. Emphasis is on the civil and architectural components of building construction, with some discussion of other elements.

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
Pre-Requisite(s): MA 1032 and MA 1031

CMG 3000 - Building Materials and Methods
An introductory course providing an overview of materials and methods used in building systems including foundations, framing, exterior cladding, interior finishes, roofing, glass and glazing, windows and doors, ceilings and floors.

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

CMG 3100 - Building Mechanical and Electrical Systems
Overview of mechanical and electrical elements which comprise building systems. Topics include HVAC systems and controls, electrical power distribution and lighting, fire detection, alarm, and communications. Emphasis is placed on understanding the integration of these elements into a building system.

Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): CET 2252
CMG 3265 - Construction Cost Estimating
Advanced study of construction cost estimating topics. Includes a review of quantity take-off, developing unit prices, subcontract work, budgets, negotiated contracts, and related items. Computer applications software is incorporated in the course.

Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): CMG 2265

CMG 4000 - Professional Practice
Office practices, financial, legal, and ethical considerations in construction management are illustrated and discussed.

Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Class(es): Senior
Pre-Requisite(s): BA 2300 and BA 2500

CMG 4100 - Construction Equipment Management
Study of basic principles used in the construction industry for selecting and managing construction equipment. Focuses on understanding the time value of money, estimating equipment ownership and operating costs, selecting the proper equipment for specific tasks, and estimating equipment production.

Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Class(es): Senior
Pre-Requisite(s): CMG 3265

CMG 4120 - Construction Planning and Scheduling
A study of planning and scheduling techniques, network diagrams, CPM calculations, construction schedules, and project cash flow. Time schedules for materials, labor, and equipment are evaluated. Integrates the use of computer software as a scheduling tool.

Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Class(es): Senior
Pre-Requisite(s): CMG 3265

CMG 4200 - Contract Administration
A study of construction documents, the project manual, report requirements, agreements, change orders, and other administrative functions in building construction.

Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Class(es): Senior
Pre-Requisite(s): CMG 4000
CMG 4500 - Senior Project
Capstone course that integrates all aspects of the construction management process. Students will explore the responsibilities of the construction manager and consider project management issues in the context of a semester-long simulated construction project. Includes oral and written report components in addition to a comprehensive exam.
Credits: 2.0
Lec-Rec-Lab: (0-2-0)
Semesters Offered: Fall, Spring
Restrictions: Must be enrolled in one of the following Major(s): Construction Management; Must be enrolled in one of the following Class(es): Senior
Co-Requisite(s): CMG 4999
Pre-Requisite(s): CMG 4120

CMG 4911 - Construction Safety
An examination of construction safety issues. Topics include, but are not limited to: fall protection, scaffolding, material handling, personal protective equipment, excavations.
Credits: 1.0
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior

CMG 4999 - Professional Practice Seminar
Provides a curriculum review and prepares the student to sit for the Associate Constructor examination.
Credits: 1.0
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Fall, Spring
Restrictions: Must be enrolled in one of the following Class(es): Senior
Co-Requisite(s): CMG 4500
Computer Science

CS 1000 - Explorations in Computing
An introduction to the study of computing: fundamental concepts and skills; opportunities at Michigan Tech; career opportunities; social and ethical issues.
Credits: 1.0
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Major(s): Computer Engineering, Electrical Engineering, Computer Science, Computer Systems Science, Software Engineering; Must be enrolled in one of the following Class(es): Freshman

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; introduction to program running time, and counting instructions. Emphasizes scientifically oriented problems in the programming assignments.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Major(s): Computer Science
Pre-Requisite(s): MA 1032 or MA 1031 or MA 1135(C) or MA 1140(C) or MA 1150(C) or MA 1151(C) or MA 1160(C) or MA 1161(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
Semesters Offered: On Demand
Restrictions: Permission of instructor required

CS 1121 - Introduction to Computer Science I
Starting point of the computer science programs. 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: (0-2-2)
Semesters Offered: Fall, Spring, Summer
Pre-Requisite(s): MA 1032(C) or MA 1031(C)

CS 1122 - Introduction to Computer Science II
Continuation of CS 1121. Topics include data abstraction, class hierarchies and polymorphism, list, stack and queue data structures, informal complexity-based algorithm and data structure choices, and recursion. Homework programming assignments are given. Not open to students with credit in CS1129.
Credits: 2.0
Lec-Rec-Lab: (0-2-0)
Semesters Offered: Fall, Spring, Summer
Pre-Requisite(s): CS 1121
CS 1129 - Introduction to Computer Science II in C++
Continuation of CS1121. Topics include data abstraction, class hierarchies and polymorphism, list, stack and queue data structures, informal complexity-based algorithm and data structure choices, and recursion. The C and C++ programming languages are presented and uses. Not open to students with credit in CS1122.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring
Restrictions: May not be enrolled in one of the following Major(s): Computer Engineering, Computer Science, Computer Systems Science, Software Engineering
Pre-Requisite(s): CS 1121

CS 1131 - Computer Science I
An alternative starting point of the computer science programs 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)
Semesters Offered: Fall, Spring
Restrictions: Permission of department required
Pre-Requisite(s): MA 1032 or MA 1031

CS 1721 - Object Oriented Design
Principles of object oriented design. Includes the software life cycle and unit testing. Students are required to design, unit test, implement, and final test a relatively large project.
Credits: 1.0
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Fall, Spring
Pre-Requisite(s): CS 1121 or CS 1131

CS 2090 - 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
Semesters Offered: On Demand
Restrictions: Permission of instructor required

CS 2141 - Software Development Methods Using C/C++
This course provides an accelerated coverage of C/C++ for Java programmers. Topics include object oriented design with UML, object oriented programming with C++, C/C++ memory model, differences between C and C++ use of libraries, and debugging with modern tools.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring
Pre-Requisite(s): CS 1721 and CS 2321

CS 2311 - Discrete Structures
Presents fundamental concepts in discrete structures that are used in computer science. Topics include sets, trees, graphs, functions, relations, recurrences, proof techniques, logic, combinatorics, and probability.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring
Pre-Requisite(s): (CS 1122 or CS 1131) and (MA 1150 or MA 1151 or MA 1160 or MA 1161 or MA 1135 or MA 1140)
CS 2321 - Data Structures
Presents fundamental concepts in data structures. Topics include ADTs (trees, priority queues, dictionaries and graphs) and their implementations, algorithm analysis, sorting and text processing. Programming projects are designed to apply these topics.
**Credits:** 3.0
**Lec-Rec-Lab:** (0-3-0)
**Semesters Offered:** Fall, Spring
**Pre-Requisite(s):** CS 1122

CS 3090 - 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
**Semesters Offered:** On Demand
**Restrictions:** Permission of instructor required

CS 3141 - Team Software Project
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 responsibility.
**Credits:** 3.0
**Lec-Rec-Lab:** (0-3-0)
**Semesters Offered:** Fall, Spring
**Pre-Requisite(s):** CS 2141 and CS 2311

CS 3311 - Formal Models of Computation
Introduction to the theory of languages and computation. Topics include regular languages and finite automata, context free languages and push-down automata, context free languages and push-down automata; Turing-acceptable languages and Turing machines, and their applications such as parsing.
**Credits:** 3.0
**Lec-Rec-Lab:** (0-3-0)
**Semesters Offered:** Fall, Spring
**Pre-Requisite(s):** CS 2311

CS 3411 - Systems Programming
Development of programs on modern operating systems. Topics include: scripting; compilation, linking, loading; libraries; process creation; file system access and protection; network programming; heterogeneity.
**Credits:** 3.0
**Lec-Rec-Lab:** (0-3-0)
**Semesters Offered:** Fall
**Pre-Requisite(s):** CS 2141 and CS 3421

CS 3421 - Computer Organization
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)
**Semesters Offered:** Fall, Spring
**Pre-Requisite(s):** CS 2311
CS 3451 - Computer Administration
Administration of non-networked computers. Topics include: operating system installation; boot-up and shutdown; process management; account management; file systems; storage technology; backups; serial devices.
Credits: 4.0
Lec-Rec-Lab: (0-3-3)
Semesters Offered: Spring
Pre-Requisite(s): CS 3411 or CS 4411

CS 3621 - Computer Graphics: Elementary Geometric Objects and Processing
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)
Semesters Offered: Fall
Pre-Requisite(s): (MA 2160 or MA 2150) and (MA 2330 or MA 2320 or MA 2321) and CS 2141

CS 3911 - Introduction to Numerical Methods with FORTRAN
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)
Semesters Offered: Fall
Pre-Requisite(s): (MA 1160 or MA 1161) and (MA 2320(C) or MA 2321(C) or MA 2330(C)) and (CS 1010 or CS 1122 or CS 1131)

CS 4000 - Senior Seminar
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)
Semesters Offered: Fall, Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior
Pre-Requisite(s): CS 3141

CS 4090 - Special Topics in Computer Science
Special topics in computer science offered on occasion based on student and faculty demand and interest.
Credits: variable to 4.0; May be repeated
Semesters Offered: On Demand
Restrictions: Permission of instructor required

CS 4099 - Directed Study in Computer Science
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 6
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of instructor required
CS 4121 - Programming Languages
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)
Semesters Offered: Fall, Spring
Pre-Requisite(s): CS 1721 and CS 2321 and CS 3311

CS 4131 - Compiler Construction
Introduction to compilation techniques, including parsing, syntax-directed translation, run-time storage management, error recovery, code generation and optimization. Requires a significant project.
Credits: 4.0
Lec-Rec-Lab: (0-3-1)
Semesters Offered: Spring
Pre-Requisite(s): CS 3311 and CS 4411

CS 4311 - Introduction to Computation Theory
Provides deeper insight into the power of computing using various models of computation. Topics reviewed include proof techniques, finite automata, regular languages, pushdown automata, and context-free languages. Topics covered include Turing machines and their variants, the Halting Problem and decidability, computability, time complexity, space complexity, circuit model, and parallel computation.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): CS 3311

CS 4321 - Introduction to Algorithms
Fundamental topics in algorithm design, analysis, and implementation. Analysis fundamentals include asymptotic notation, analysis of control structures, solving recurrences, and amortized analysis. Design and implementation topics include sorting, searching, and graph algorithms. Design paradigms include greedy algorithms, divide-and-conquer algorithms, and dynamic programming.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring
Pre-Requisite(s): CS 2311 and CS 1721 and CS 2321

CS 4331 - Introduction to Parallel Programming
Introduction to developing parallel programs and solving problems using multiple concurrent processes. Shared memory and message passing paradigms are studied. Topics include conceptual models of parallel programming, basic analysis of parallel languages, parallel computer architecture, domain decomposition, and load balancing. Traditional computer science applications and numerical applications are also studied.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Pre-Requisite(s): CS 3421 and CS 4321
CS 4411 - Introduction to Operating Systems
Presents topics on program representation and execution, operating systems, process and threads, process scheduling, memory management, and file systems. Programming homework is required.
Credits: 4.0
Lec-Rec-Lab: (0-4-0)
Semesters Offered: Fall, Spring
Pre-Requisite(s): CS 2141 and CS 3421

CS 4421 - Database Systems
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)
Semesters Offered: Spring
Pre-Requisite(s): CS 4411 or CS 4321

CS 4431 - Computer Architecture
Architecture of high-performance parallel computer systems. Introduces various forms of parallelism, such as multiple functional units, pipelining, multiprocessors, and processor arrays. Also covers interleaved 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)
Semesters Offered: Fall
Pre-Requisite(s): CS 4411

CS 4451 - Network Administration
Administration of computer networks. Topics include: TCP/IP networking, mail, printing, configuring and building kernels, remote file systems, license management, managing web systems, common network administration services.
Credits: 4.0
Lec-Rec-Lab: (0-3-3)
Semesters Offered: Fall
Pre-Requisite(s): CS 3451 and CS 4461

CS 4461 - Computer Networks
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)
Semesters Offered: Spring
Pre-Requisite(s): CS 4321 and CS 4411

CS 4471 - Computer and Network Security
Development of administration of secure software systems. Topics include principles of software development, practical cryptography, program security, operating system security, network security, database security, administration, legal and ethical issues.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): CS 4461 and MA 3203
CS 4481 - Computer and Network Performance Analysis
Analysis of the performance of computer systems. Topics include measurement techniques and tools, probability theory and statistics, experiment design and analysis, simulation, queuing models. Course includes a significant experimental component.
Credits: 4.0
Lec-Rec-Lab: (0-3-3)
Semesters Offered: Spring
Co-Requisite(s): CS 4482
Pre-Requisite(s): CS 4411 and MA 2720

Introduction to interactive computer graphics. Topics include graphics terminology, 3D viewing, 3D transformation, interactive techniques, use of graphics input devices, projections, modeling, lighting, texturing, evaluators, and graphics algorithms. Requires substantial programming homework.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): CS 2141

CS 4711 - Introduction to Software Engineering
Introduction to software engineering, the study of principled approaches to developing and maintaining software. Topics include software process models, project management and measurement, software life cycle, and design techniques.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): CS 3141

CS 4712 - Software Quality Assurance
This course focuses on the aspects of the software process most closely associated with ensuring product quality. Topics include requirements, elicitation and analysis, usability engineering, formal specification, verification, and validation.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): CS 3141

CS 4750 - Teaching Methods in Computer Science
Provides teaching methods, models, and experiences for teaching computer science in secondary schools. Topics discussed include teaching methods, learning, security and maintenance of equipment, professional journals, ethics, legal issues, diversity, and problem solving. Requires admission to the Teacher Education Program.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Restrictions: Permission of department required; May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior
Pre-Requisite(s): ED 4700
CS 4760 - Human-Computer Interactions
Principles of design and implementation of human-computer interfaces (HCI). Topics include: HCI design principles, tools and theory. Students receive direct experience with the design, implementation, and evaluation of human-machine interfaces and interactions.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): CS 3141

CS 4790 - Senior Design Project
A one semester course that requires students to apply the principles and techniques of software engineering covered in CS4711 and CS4712. Each student works as part of a team responsible for developing a quality software product.
Credits: 3.0
Lec-Rec-Lab: (0-1-4)
Semesters Offered: Fall, Spring
Pre-Requisite(s): CS 4711 and CS 4712

CS 4791 - Senior Design Project I
The first semester of a two semester capstone project experience for students in the Software Engineering Degree Program. Given a major software project, students establish a team structure, determine an appropriate project schedule and scope, and begin development.
Credits: 3.0
Lec-Rec-Lab: (0-1-4)
Semesters Offered: Fall
Pre-Requisite(s): CS 4711 and CS 4712(C)

CS 4792 - Senior Design Project 2
Students complete the project started in CS4791. The project is evaluated by the students, and a final presentation is made to the customer.
Credits: 3.0
Lec-Rec-Lab: (0-1-4)
Semesters Offered: Fall, Spring
Pre-Requisite(s): CS 4791

CS 4811 - 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: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): CS 4121
Economics

EC 2002 - Principles of Microeconomics
Basic microeconomics including theory of consumer choice, theory of the firm, value or price theory, and distribution theory.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring, Summer
Restrictions: Must be enrolled in one of the following College(s): School of Business & Economics

EC 2003 - Principles of Macroeconomics
Basic macroeconomics with an introduction to the American economy, national income analysis, fiscal policy, money and monetary policy, the commercial banking system, and the Federal Reserve System.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring, Summer
Restrictions: Must be enrolled in one of the following College(s): School of Business & Economics
Pre-Requisite(s): EC 2002(C)

EC 3001 - 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: (3-0-0)
Semesters Offered: Fall, Spring, Summer
Pre-Requisite(s): UN 2002

EC 3002 - 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: (3-0-0)
Semesters Offered: Spring, Summer
Pre-Requisite(s): (EC 3001 or EC 2002) and UN 2002 and (MA 1135 or MA 1140 or MA 1150 or MA 1151 or MA 1160 or MA 1161 or MAT 1195)

EC 3003 - 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: (3-0-0)
Semesters Offered: Fall, Summer
Pre-Requisite(s): (EC 3001 or EC 2003) and UN 2002 and (MA 1135 or MA 1140 or MA 1150 or MA 1151 or MA 1160 or MA 1161 or MAT 1195)
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: On Demand - Offered alternate years beginning with the 2000-2001 academic year
Pre-Requisite(s): EC 3001 or EC 2002 or EC 2003 and (UN 2002 or 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: Fall, Summer - Offered alternate years beginning with the 2000-2001 academic year
Pre-Requisite(s): EC 3001 or EC 2002 or EC 2003 and UN 2002

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: (3-0-0)
Semesters Offered: Fall, Spring, Summer
Pre-Requisite(s): EC 3001 or (EC 2002 and EC 2003) 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
Pre-Requisite(s): (EC 3001 or EC 2002) 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 ten weeks of the course;EC3403 is the last five weeks. See EC3401-3 for contents.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring, Summer
Restrictions: May not be enrolled in one of the following College(s): School of Business & Economics; May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): UN 2002
EC 3401 - Economic Decision Analysis I
For students who want to take EC3400 in modules. Covers interest rate calculations, loan repayments, and decision making tools including rate of return, present annual worth, and benefit/cost ratio. Discusses project evaluation including depreciation, taxes and cash flows. Taught in the first ten weeks of EC3400.
Credits: 2.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring
Restrictions: May not be enrolled in one of the following College(s): School of Business & Economics; May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): UN 2002

EC 3403 - Economic Decision Analysis II
For students who want to take EC3400 in modules. Provides an understanding of the setting in which effective decisions are made: covers business organization, financial statements, risk and uncertainty, project and business financing, and capital budgeting. Taught during the third five weeks of EC3400.
Credits: 1.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring
Restrictions: May not be enrolled in one of the following College(s): School of Business & Economics; May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): (EC 3401(C) or ENT 3401(C)) and UN 2002

EC 3500 - 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: (3-0-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2001-2002 academic year
Pre-Requisite(s): (EC 3001 or EC 2002 or EC 2003) 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, wage determination, human capital theory, returns to education 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 2001-2002 academic year
Pre-Requisite(s): EC 3001 or (EC 2002 and EC 2003) and UN 2002 and (BA 2100 or MA 2710 or MA 2720 or MA 3710)

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; May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior
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  
**Pre-Requisite(s):** (EC 3001 or EC 3002 or EC 3003 or EC 2002 or EC 2003) and (BA 2100 or MA 2710 or MA 2720 or MA 3710) and (MA 1135 or MA 1140 or MA 1150 or MA 1151 or MA 1160 or MA 1161 or MAT 1195)

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  
**Pre-Requisite(s):** (EC 3003 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:** (3-0-0)  
**Semesters Offered:** Spring  
**Pre-Requisite(s):** (EC 3001 or EC 2002 or EC 2003) and UN 2002

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  
**Pre-Requisite(s):** (EC 3001 or EC 3002 or EC 3003 or EC 2002 or EC 2003) and UN 2002

EC 4630 - 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, Spring  
**Pre-Requisite(s):** (EC 3001 or EC 2002 or EC 2003) 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 of third party, medical school funding and admission policy, insurance and prepayment, and health and economic development.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Pre-Requisite(s): (EC 3001 or EC 2003) and UN 2002

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: On Demand
Pre-Requisite(s): (EC 3001 or EC 2002 or EC 2003) and UN 2002

EC 4900 - 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
Semesters Offered: On Demand
Pre-Requisite(s): EC 3001 or EC 2002 or EC 2003

EC 4990 - Special Topics in Economics
Economic topics of interest to students and faculty.
Credits: variable to 4.0; Repeatable to a Max of 6
Semesters Offered: On Demand
Pre-Requisite(s): EC 3001 or EC 2002 or EC 2003

Education

ED 2010 - Field Study in Education: Elementary School
Observations in an elementary school, offering relevant school experience to help clarify career goals.
Credits: 1.0
Lec-Rec-Lab: (0-0-2)
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.
Credits: 1.0
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring
Restrictions: Permission of department required
ED 3100 - Instructional Technology
Provides the development of knowledge and skills required to make use of 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. Not open to students with credit in ED2100.
Credits: 2.0
Lec-Rec-Lab: (0-2-0)
Semesters Offered: Fall, Spring, Summer
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore

ED 3110 - Psychological Foundations of Learning
The course examines how human beings grow and learn with major emphasis on the early adolescent and adolescent. Psychological basis of educational procedures and practices are established with special reference to learning disorders, gifted children, and culturally diverse classrooms.
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): Freshman, Sophomore
Pre-Requisite(s): PSY 2000 and UN 2002

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: (0-2-0)
Semesters Offered: Fall, Spring
Restrictions: Permission of department required; May not be enrolled in one of the following Class(es): Freshman, Sophomore
Co-Requisite(s): ED 3110, ED 3410
Pre-Requisite(s): UN 1002 or UN 1003

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 the Teacher Education program.
Credits: 1.0
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Fall, Spring
Restrictions: Permission of department required; May not be enrolled in one of the following Class(es): Freshman, Sophomore
Co-Requisite(s): ED 3110, ED 3210

ED 3510 - Communicating Science I
Students will learn how to design and deliver hands-on presentations to K-8 students and their parents. Presentations will be delivered at 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, Summer
Pre-Requisite(s): UN 2002
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, Summer
Pre-Requisite(s): UN 2002

ED 4020 - Methods of Teaching Social Studies
Application of learning and instructional theories and practice to the teaching of social studies.
Emphasis will include application of state and national education standards and relevant assessment strategies for social studies. Requires admission to the Teacher Education program by the Department of Education.
Credits: 2.0
Lec-Rec-Lab: (0-2-0)
Semesters Offered: Spring
Restrictions: Permission of department required
Pre-Requisite(s): ED 3110 and ED 3100 and ED 3210 and ED 3410 and (ED 4150 or HU 4150) and ED 4700

ED 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. Requires admission to teacher education program or permission of instructor.
Credits: 4.0
Lec-Rec-Lab: (0-3-3)
Semesters Offered: Fall
Restrictions: Permission of department required
Pre-Requisite(s): ED 3110 and ED 3210 and ED 3410 and ED 4700(C)

ED 4150 - Literacy in the Content Areas
Introduction to literacy processes 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

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
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
Semesters Offered: Fall, Spring
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
Semesters Offered: Fall, Spring
Restrictions: Permission of instructor required

ED 4700 - Fundamentals of Instruction
Study of key areas of instruction in preparation for student teaching. Emphasis is placed on lesson planning, classroom management, and student assessment and evaluation. Requires admission to the teacher education program by the Department of Education.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring
Restrictions: Permission of department required; May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior
Pre-Requisite(s): ED 3110 and ED 3210 and ED 3410

ED 4710 - Methods of Teaching Science and Mathematics
Application of learning and instructional theories to the teaching of science and mathematics.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring
Restrictions: Permission of department required; May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior
Pre-Requisite(s): ED 4700(C)

ED 4740 - Methods of Teaching Business
Application of learning theories and national and state standards to the teaching of business. Emphasizes methods, materials, and media used to teach adolescents. Requires admission to the teacher education program by the Department of Education.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Restrictions: Permission of department required
Pre-Requisite(s): ED 4700(C)

ED 4750 - Teaching Methods in Computer Science
Provides teaching methods, models, and experiences for teaching computer science in secondary schools. Topics discussed include teaching methods, learning, security and maintenance of equipment, professional journals, ethics, legal issues, diversity, and problem solving. Requires admissions to the Teacher Education Program.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Restrictions: Permission of department required; May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior
Pre-Requisite(s): ED 4700
ED 4850 - Environmental Education Methods
This course will prepare students to design and conduct environmental education programs for adults and youth in classrooms, parks, museums, nature centers, and through statewide outreach programs using a variety of teaching methods, hands-on-activities, and scientific investigations.

Credits: 4.0
Lec-Rec-Lab: (2-1-1)
Semesters Offered: On Demand
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): UN 2002

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; May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior
Pre-Requisite(s): ED 3100 and ED 4700 and (HU 4140(C) or ED 4710(C) or SS 4020(C) or ED 4740)

Electrical Engineering

EE 1000 - Explorations in Computing
Introduction to the full spectrum of computing disciplines offered at Michigan Tech. Topics include an introduction to technical aspects of the various disciplines, degree choices, career opportunities, ethical issues, and the impact of computers on modern society.

Credits: 1.0
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Major(s): Computer Engineering, Electrical Engineering, Engineering Undeclared, Computer Science, Computer Systems Science, Software Engineering

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, Summer
Pre-Requisite(s): EE 2150 and (MA 3520 or MA 3521 or MA 3530 or MA 3560)

EE 2150 - 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, Summer
Pre-Requisite(s): (MA 2160 or MA 2150) and (CS 1121 or CS 1131)
EE 2171 - Digital Logic
Introduces analysis, design, and application of digital logic. Includes Boolean algebra, binary numbers, logic gates, combinational and sequential logic, storage elements, schematic and hardware-description-language based synthesis.
Credits: 2.0
Lec-Rec-Lab: (2-0-0)
Semesters Offered: Fall, Spring, Summer
Pre-Requisite(s): CS 1121 or CS 1131

EE 2190 - Introduction to Photonics
Topics include basic geometrical and wave optics, fiber optics, lasers, detectors, and optical communication systems.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Pre-Requisite(s): MA 3521 and PH 2200(C)

EE 2303 - Introduction to ECE Lab
First laboratory course in Electrical Engineering. Introduces basic concepts of laboratory practice, measurements, instruments, modeling and simulation tools.
Credits: 1.0
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Fall, Spring, Summer

EE 2304 - Logic and Signals Lab
Experimental solution of engineering problems. Includes design, simulation, and evaluation; advanced measurement techniques in digital and signal processing systems.
Credits: 1.0
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring, Summer
Pre-Requisite(s): EE 2150 and EE 2171 and EE 2303

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): Computer Engineering, 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
Pre-Requisite(s): EE 2110 or EE 3010
EE 3130 - Electronics
Covers the fundamentals of electronic circuits and devices.
Credits: 3.0  
Lec-Rec-Lab: (3-0-0)  
Semesters Offered: Fall, Spring  
Pre-Requisite(s): EE 2110 or EE 3010

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  
Pre-Requisite(s): PH 2200 and (MA 3160 or MA 3150)

EE 3160 - Linear Systems and Control
Introduces the mathematical analysis of signals, systems, and control. Topics include differential equations, Fourier series, Fourier transforms, LaPlace transforms, frequency response, Bode plots, state models, and an introduction to control systems.
Credits: 3.0  
Lec-Rec-Lab: (3-0-0)  
Semesters Offered: Fall, Spring, Summer, Summer temporary  
Pre-Requisite(s): EE 2150 and EE 2110 and (MA 2320 or MA 2321 or MA 2330) and (MA 3520 or MA 3521 or MA 3530 or MA 3560)

EE 3170 - Microcontroller Applications
Introduces the concept of microcontroller-based systems. Describes some basic characteristics of microcontrollers and then goes into significant depth in the applications of a single microcontroller. Topics include polled, interrupt and DMA input/output, assembly language, instruction set architecture interface and ASICs.
Credits: 3.0  
Lec-Rec-Lab: (3-0-0)  
Semesters Offered: Fall, Spring  
Restrictions: May not be enrolled in one of the following Major(s): Computer Engineering  
Pre-Requisite(s): EE 2171

EE 3173 - Hardware/Software System Integration
Covers the integration of hardware and software into a complete working system. Includes design and construction of I/O devices for microprocessor - or microcontroller-based systems, communication and bus protocols, programming in assembler language and in "C", system integration and testing. Also covers the use and integration of FPGAs using both schematic capture and HDL design tools.
Credits: 4.0  
Lec-Rec-Lab: (0-3-3)  
Semesters Offered: Fall, Spring  
Restrictions: Must be enrolled in one of the following Major(s): Computer Engineering  
Pre-Requisite(s): EE 2304 and EE 3130 and CS 2141 and CS 3421
EE 3175 - Computer Architecture with Modeling and Simulation
Covers the theory and practice of using computer-aided modeling and simulation as tools for digital system design. Topics are drawn from both discrete event simulation and stochastic modeling of system performance and reliability, including Monte Carlo approaches, queueing models, and Markov models. Includes system modeling programming assignments.
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 Engineering
Pre-Requisite(s): CS 2141 and CS 3421 and CS 3911 and (MA 3710 or MA 3720) and EE 2171

EE 3190 - Optical Sensing and Imaging
Optical sensing techniques, including imaging and non-imaging systems.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Pre-Requisite(s): EE 2190

EE 3221 - 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: Spring
Pre-Requisite(s): EE 2110 or EE 3010

EE 3291 - Light Wave Devices
Light wave propagation in optical crystals and fibers, detection and creation of light in semiconductors.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Major(s): Electrical Engineering, Applied Physics, Physics; Must be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): EE 3190

EE 3305 - Circuit and Analysis Lab
Covers circuit design and analysis, and linear system applications
Credits: 1.0
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring, Summer
Restrictions: Must be enrolled in one of the following Major(s): Computer Engineering, Electrical Engineering
Pre-Requisite(s): EE 2110 and EE 2304

EE 3306 - Electronic Design with Microprocessor Applications
Covers the design and analysis of electronic circuits with microprocessor applications
Credits: 1.0
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring, Summer
Restrictions: Must be enrolled in one of the following Major(s): Electrical Engineering
Pre-Requisite(s): EE 3305 and EE 3130 and EE 3170
EE 3391 - Photonics Laboratory
Basic optics lab experience covering geometrical optics, fiber optics, interferometry and diffraction. Optical measurements and laser safety are also covered.
Credits: 1.0
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Major(s): Electrical Engineering; May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): EE 2190 and EE 3190

EE 3805 - 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 6; Graded Pass/Fail Only
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of instructor and department required

EE 3970 - Computer Engineering Professional Development
Introduces professional topics such as team organization, plagiarism, ethics, IEEE writing, speaking and citation styles, experimental design, data gathering and analysis, software instrumentation, benchmarking, and industry standards. Individual and team projects require integration of knowledge across prerequisite course boundaries.
Credits: 2.0
Lec-Rec-Lab: (2-0-0)
Semesters Offered: Fall, Spring
Restrictions: Must be enrolled in one of the following Major(s): Computer Engineering
Pre-Requisite(s): CS 2141 and (MA 3710 or MA 3720) and CS 3911

EE 4211 - 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
Restrictions: Must be enrolled in one of the following Major(s): Computer Engineering, Electrical Engineering
Pre-Requisite(s): EE 2110

EE 4221 - Power System Analysis 1
Complex Power flow in circuits and the effects of real and reactive power flow on a system; transformer and load representations in power systems; power transmission line parameters and steady-state operation of transmission lines; the per unit system; development of the bus admittance matrix; power flow.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): EE 3120
EE 4222 - Power System Analysis 2
Topics covered include symmetrical components; symmetrical faults; unbalanced faults; generating the bus impedance matrix and using it in fault studies; power system protection; power system operation; power system stability.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): EE 4221

EE 4223 - Power System Protection
Real-time monitoring and protection of modern power systems. Secure and reliable operation of radial and grid systems. Protection of transmission lines, buses, generators, motors, transformers, and other equipment against disturbances.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2004-2005 academic year
Pre-Requisite(s): EE 4221 and EE 4222(C)

EE 4224 - Power System Protection Lab
Theory-based application of software and hardware used for power system protection. Fault simulations, protective relay settings and coordination, and test operation of relays under static, dynamic, and transient conditions.
Credits: 1.0
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Spring - Offered alternate years beginning with the 2004-2005 academic year
Pre-Requisite(s): EE 4223(C)

EE 4225 - Distribution Engineering
Modeling and analysis of electrical distribution systems; load characteristics, load modeling, unbalanced three-phase overhead and underground line models, and distribution transformers. Analysis of over current protection, voltage drop, and power quality
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2005-2006 academic year
Restrictions: Must be enrolled in one of the following Major(s): Computer Engineering, Electrical Engineering
Pre-Requisite(s): EE 4221

EE 4231 - 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
Pre-Requisite(s): EE 3130
EE 4232 - 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
Pre-Requisite(s): EE 3130

EE 4240 - Introduction to MEMS
Fundamentals of micromachining and microfabrication techniques, including planar thin-film process technologies, photolithographic techniques, deposition and etching techniques, and the other technologies that are central to MEMS fabrication.
Credits: 4.0
Lec-Rec-Lab: (3-1-0)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior

EE 4240D - Introduction to MEMS
Fundamentals of micromachining and microfabrication techniques, including planar thin-film process technologies, photolithographic techniques, deposition and etching techniques, and the other technologies that are central to MEMS fabrication.
Credits: 4.0
Lec-Rec-Lab: (3-1-0)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior

EE 4250 - Communication Theory
Introduces the mathematical theory of communication science. Topics include baseband 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
Pre-Requisite(s): EE 3160 and MA 3720

EE 4252 - Digital Signal Processing and it's Applications
Digital signal processing techniques with emphasis on applications. 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, physical limitations, image processing basics, image enhancement, image restoration and image coding.
Credits: 4.0
Lec-Rec-Lab: (0-3-2)
Semesters Offered: Fall
Pre-Requisite(s): EE 3160 and EE 2150
EE 4253 - Real Time Signal Processing
Practical implementation of digital signal processing concepts as developed in EE4252. 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
Pre-Requisite(s): EE 4252

EE 4255 - Wireless Communications
Principles of wireless communication systems. Projects may include cell phones, computer networks, paging systems, satellite communications, radio, television and telemetry.

Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): EE 4252

EE 4256 - Fourier Optics
Analysis and modeling of diffraction effects in optical systems, emphasizing frequency-domain analytic and computational approaches. Presents wave propagation, imaging, and optical information processing applications.

Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Major(s): Electrical Engineering
Pre-Requisite(s): EE 3190

EE 4257 - Digital Image Processing
Image formation, enhancement and reconstruction. Applications in medical imaging, computer vision, and pattern recognition.

Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Major(s): Electrical Engineering
Pre-Requisite(s): EE 3160 and EE 3190

EE 4261 - 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
Pre-Requisite(s): EE 3160
EE 4262 - 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
Pre-Requisite(s): EE 4261

EE 4271 - 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, Summer
Pre-Requisite(s): EE 2171 and EE 3130

EE 4272 - Computer Networks
Focuses on the fundamental network architecture concepts and the core design principles and issues in the emerging communication/data networks. The course systematically gives students the complete picture of data and computer networks.

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, Sophomore
Pre-Requisite(s): EE 2150 and (MA 3710 or MA 3720)

EE 4290 - Optical Communication
Fundamentals of fiber optics communications, including sources, transmission media, detectors, signal processing, and networking.

Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Major(s): Electrical Engineering
Pre-Requisite(s): EE 3291

EE 4411 - Engineering Electromagnetics
A mathematically rigorous study of dynamic electromagnetic fields, beginning with Maxwell’s equations. Topics include scalar and vector potentials, waves, and radiation.

Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Pre-Requisite(s): EE 3140

EE 4441 - Laser Types, Laser Design, Modeling Techniques, and Nonlinear Optics
Survey of laser types and analysis of the common physical and engineering principles, including energy states, inversion, gain, and broadening mechanisms. Design issues include resonators, packaging, cooling, pulsed power, and safety. Students will construct a computational model that predicts laser performance. Nonlinear optics and selected applications also covered.

Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Pre-Requisite(s): EE 3140
EE 4800 - Special Topics in Electrical Engineering
Covers specific topics in electrical engineering.
Credits: variable to 4.0; Repeatable to a Max of 6
Semesters Offered: On Demand
Restrictions: Permission of instructor and department required

EE 4805 - 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 6; Graded Pass/Fail Only
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of instructor and department required

EE 4870 - Special Topics in Computer Engineering
Covers special topics in computer engineering.
Credits: variable to 4.0; Repeatable to a Max of 6
Semesters Offered: On Demand
Restrictions: Permission of instructor and department required

EE 4875 - 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 6; Graded Pass/Fail Only
Semesters Offered: On Demand
Restrictions: Permission of instructor and department required

EE 4900 - 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
Pre-Requisite(s): EE 4901(C)

EE 4901 - EE Design Project 1
The first semester of a program of study in which a group of students work on an engineering design project in consultation with a faculty member. (Senior project ready as defined by major substitutes for prerequisites)
Credits: 2.0
Lec-Rec-Lab: (0-1-3)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior
Co-Requisite(s): EE 4900
Pre-Requisite(s): (EE 3305 or EE 3173) and (EE 3175 or EE 3130) and (EE 3305 or EE 3970)

EE 4910 - 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. (Senior project ready as defined by major substitutes for prerequisites)
Credits: 3.0
Lec-Rec-Lab: (0-1-6)
Semesters Offered: Spring
Pre-Requisite(s): EE 4901
Electrical Engrg Technology

EET 1120 - Circuits I
Defines resistance, voltage, current, energy, and power, followed by DC network analysis and network theorems. Includes the analysis of transients in capacitive and inductive networks. Lab exercises use electronic test equipment to analyze circuits constructed from schematics.
Credits: 4.0
Lec-Rec-Lab: (0-3-2)
Semesters Offered: Fall, Spring
Pre-Requisite(s): MA 1031(C) or MA 1032(C)

EET 1411 - Basic Electronics
Introduction to basic electrical principles and electronic devices, including dc and ac circuits, diodes, transistors, operational amplifier ICs, power supply regulation and power supply design.
Credits: 4.0
Lec-Rec-Lab: (0-3-2)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Major(s): Computer Network & System Admin
Pre-Requisite(s): MA 1030(C)

EET 2120 - Circuits II
Defines and applies sinusoidal steady-state AC concepts such as impedance, complex power, resonance, and frequency response. Applies basic network analysis tools to AC single phase and balanced three-phase networks, bridge circuits, and filters. AC circuit principles are reinforced by coordinated lab exercises.
Credits: 4.0
Lec-Rec-Lab: (0-3-2)
Semesters Offered: Fall, Spring
Pre-Requisite(s): EET 1120 and (MAT 1195 or MA 1160(C) or MA 1161(C) or MA 1150(C) or MA 1135(C) or MA 1140(C))

EET 2141 - Digital Electronics and Microprocessor Fundamentals
A study of the fundamental components used in digital logic circuits and microcomputer architecture and programming. Topics include: number systems and codes, Boolean algebra, combinational logic circuits, flip-flops, arithmetic circuits, counters and registers, decoders, multiplexers, memory organization, microcomputer addressing modes, stacks and subroutines.
Credits: 4.0
Lec-Rec-Lab: (0-3-3)
Semesters Offered: Spring
Pre-Requisite(s): EET 1120 or EET 1411 or EET 2311

EET 2220 - Electronic Devices & Circuits
Introduction to 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: 4.0
Lec-Rec-Lab: (0-3-3)
Semesters Offered: Fall, Spring
Pre-Requisite(s): EET 2120
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  
Pre-Requisite(s): EET 2120(C) or EET 2311(C)

EET 2241 - Structure and Assembly Programming
Introduction to C++ programming and MATLAB for use in solving problems encountered in engineering technology. C++ topics include the basics of syntax and program structure. Focus on the basic capabilities of MATLAB and its programming environment.

Credits: 3.0  
Lec-Rec-Lab: (0-2-2)  
Semesters Offered: On Demand  
Pre-Requisite(s): EET 2141(C)

EET 2311 - Electricity and Electronic Devices
A study of elementary DC and AC electrical networks and devices leading to the analysis of strain gage and LVDT instrumentation circuits and AC power. Circuit devices include voltage sources, resistors, strain gages, capacitors, inductors, diodes, LVDTs, and operational amplifiers.

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 Eng Tech (AAS), Electromechanical Eng Tech  
Pre-Requisite(s): MA 1031(C) or MA 1032(C)

EET 2411 - Digital Electronics
Introduction to the fundamentals of the digital electronics that make up microprocessors. Topics include number systems and codes, Boolean algebra, combinational and and sequential logic circuits, arithmetic circuits, digital memory.

Credits: 2.0  
Lec-Rec-Lab: (0-1-2)  
Semesters Offered: Spring  
Restrictions: Must be enrolled in one of the following Major(s): Computer Network & System Admin  
Co-Requisite(s): EET 2412  
Pre-Requisite(s): EET 1411 and (MA 1031(C) or MA 1032(C))

EET 2412 - Data Communications
Introduction to the fundamentals of basic data communications methods. Topics include digital communications and fiber optics.

Credits: 2.0  
Lec-Rec-Lab: (0-2-0)  
Semesters Offered: Spring  
Restrictions: Must be enrolled in one of the following Major(s): Computer Network & System Admin  
Co-Requisite(s): EET 2411  
Pre-Requisite(s): EET 1411 and (MA 1031(C) or MA 1032(C))
EET 3131 - Instrumentation
An investigation of transducers and where they are used. Topics include sensitivity, linearity, hysteresis, process measurements, and position, motion and force measurements.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Spring
Pre-Requisite(s): EET 2311 or EET 2220

EET 3225 - Special Electronic Devices
An advanced course in the study of linear integrated circuits. Includes op amps, comparators, waveform 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
Pre-Requisite(s): EET 2220

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
Pre-Requisite(s): EET 2220

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: 3.0
Lec-Rec-Lab: (0-2-3)
Semesters Offered: Spring
Pre-Requisite(s): EET 1411 or EET 2220 or EET 2311 or EE 3010

EET 3367 - Communications Systems
A basic course in communications systems. Includes information theory, AM receiving and transmission, SSB, frequency and phase angle modulation systems, TV, and frequency synthesis. Also includes system modeling using block diagrams and analysis of typical circuits.
Credits: 4.0
Lec-Rec-Lab: (0-3-3)
Semesters Offered: Fall
Pre-Requisite(s): EET 3225

EET 3373 - Introduction to Programmable Controllers
The design of discreet 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
Pre-Requisite(s): EET 2311 or (EET 2120 and EET 2141) or EET 2411
EET 3390 - Power Systems
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: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): EET 2233

EET 3700 - Electrical Power, Machinery, and Programmable Logic Controller Basics
Fundamental steady-state analysis of electrical machinery, including transformers, DC machines, polyphase and single phase AC machines. Relay logic is used to introduce ladder logic and then a transition is made to use ladder logic of a PLC.
Credits: 4.0
Lec-Rec-Lab: (0-3-3)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Major(s): Electrical Eng Tech (AAS), Electrical Eng Tech (BS), Electromechanical Eng Tech
Pre-Requisite(s): EET 2311 or EET 2220

EET 4141 - Microcomputer Interfacing
The design of systems, hardware, and software needed to perform serial and parallel data transmission between microcomputers. Data collection using analog to digital converters, and analog and digital control outputs.
Credits: 4.0
Lec-Rec-Lab: (0-3-3)
Semesters Offered: Fall
Pre-Requisite(s): EET 2141 or CS 1121

EET 4311 - Advanced Circuits and Controls
This course considers the modeling, design and implementation of basic and advanced process control strategies. Process modeling and dynamics will be considered using LaPlace transform analysis. Control techniques addressed will include feedback, cascade, feedforward, multivariable and model based methods.
Credits: 4.0
Lec-Rec-Lab: (0-3-3)
Semesters Offered: Fall
Pre-Requisite(s): (EET 3353 or EET 3131) and (MA 2540(C) or MA 3520(C) or MA 3521(C) or MA 3530(C) or MA 3560(C))

EET 4367 - Wireless Communications
A continuation of EET3267. 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: (0-3-3)
Semesters Offered: Spring
Pre-Requisite(s): EET 3367 and (MA 2140 or MA 2160)
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
Pre-Requisite(s): EET 3373

EET 4470 - Project Management and Professional Practices for Electrical Engineering Technology
Covers project management and professional practices as applied to the electrical engineering technology field. Discusses application of systems analysis to project definition and selection. Includes project teams and interactions, project planning, scheduling, and control tools. Emphasizes the use of computers. Open only to Electrical Engineering Technology students.
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, Sophomore

EET 4480 - Senior Project
A capstone course requiring the application of knowledge gained in lower division courses. Projects are normally team oriented, require weekly progress reports, and culminate with a final report and oral presentation.
Credits: 3.0; Repeatable to a Max of 6
Lec-Rec-Lab: (1-0-2)
Semesters Offered: Fall, Spring, Summer
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): EET 4470

EET 4999 - Professional Practice Seminar
A review of the latest developments in electrical engineering technology.
Credits: 1.0
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Fall, Spring
Restrictions: Must be enrolled in one of the following Major(s): Electrical Eng Tech (BS); Must be enrolled in one of the following Class(es): Senior
Exercise Science & Health

EH 1000 - Introduction to Exercise Science
Introduction to the fields and career opportunities in the exercise sciences.
Credits: 1.0
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Fall

EH 2029 - Ski Patrol (First Aid)
Second 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.
Credits: 1.0
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Fall
Pre-Requisite(s): PE 2028

EH 2470 - Lifeguard First Aid
Lecture, demonstration, and practice of first aid knowledge and skills. Adult, child, and infant CPR skills will be covered as well as AED.
Credits: 1.0
Lec-Rec-Lab: (0-0-1)
Semesters Offered: Fall
Co-Requisite(s): PE 1470

EH 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: 1.0
Lec-Rec-Lab: (1-0-0)
Semesters Offered: Spring
Co-Requisite(s): PE 1580

EH 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: (1-0-1)
Semesters Offered: Fall
Restrictions: Permission of department required

EH 3100 - Exercise Assessment and Prescriptions
Theory and practical aspects of exercise testing and prescription; topics include testing of strength, endurance, cardiovascular endurance, flexibility, body composition, muscle power, and balance with special considerations for arthritis, osteoporosis, dyslipidemia, immunology, and metabolic syndrome.
Credits: 3.0
Lec-Rec-Lab: (2-0-3)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
EH 3200 - Foundations of Kinesiology
The study of the motion of the human body. Examines the physical, biological, social and psychological aspects of physical activity, sports and exercise. Bone, joint and muscle biomechanics are examined as related to sports and physical activity. Applications to the health and fitness professions are discussed.

Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Pre-Requisite(s): BL 2010 and BL 2011 and BL 2020 and BL 2021

EH 3985 - First Aid/CPR
Lecture, demonstration, and practice of first aid knowledge and skills. Adult, child, and infant CPR skills will be covered as well as AED. Offered the first and second half of fall and spring semesters.

Credits: 1.0
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring

EH 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: (0-2-1)
Semesters Offered: Fall, Spring
Pre-Requisite(s): UN 1002 or UN 1003

EH 4020 - Foundations of Coaching
Practical and relevant information appropriate for beginning and experienced interscholastic coaches. Successful completion of this course will earn a PACE certificate recognized by the state of Michigan.

Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Fall

EH 4050 - Intro to Athletic Training
Designed for coaches. Covers first aid, adult CPR, child CPR, and other sport training issues. Students receive appropriate certification cards.

Credits: 3.0
Lec-Rec-Lab: (2-0-1)
Semesters Offered: Fall, Spring

EH 4070 - Curriculum and Methods of Teaching and Coaching
Students will demonstrate knowledge of skills, tactics and strategies, and sporting principles in planning learning experiences in various physical activities for children K-12, with consideration of appropriate growth, development, and learning. Offered spring semester.

Credits: 3.0
Lec-Rec-Lab: (2-0-1)
Semesters Offered: Spring - Offered alternate years beginning with the 2006-2007 academic year
Pre-Requisite(s): EH 4010 and EH 4020
EH 4080 - Organization of Facilities
Topics to be included (but not exclusive of) are risk management, administration of personnel, organization, and administrative efficiency in implementing sports programs. Offered spring.
**Credits:** 2.0  
**Lec-Rec-Lab:** (1-0-1)  
**Semesters Offered:** Spring - Offered alternate years beginning with the 2007-2008 academic year  
**Pre-Requisite(s):** EH 4020

EH 4090 - Theory of Training
Fundamentals of training, endurance, and sprint athletics. Topics include goal setting, intensities, lactate threshold, oxygen uptake, recovery, periodization, injuries, and nutrition. Offered spring semester.
**Credits:** 1.0  
**Lec-Rec-Lab:** (1-0-1)  
**Semesters Offered:** Spring - Offered alternate years beginning with the 2006-2007 academic year

EH 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:** (0-0-4)  
**Semesters Offered:** Fall, Spring  
**Restrictions:** Permission of instructor required  
**Pre-Requisite(s):** EH 4010 and EH 4020

EH 4200 - Sports Nutrition Seminar
Human nutrition as it specifically applies to athletes. Specific needs for proteins, carbohydrates, fats, electrolytes and micronutrients. Use of ergogenic aids is covered. Students will research, write and present orally their findings on nutrition topics.
**Credits:** 2.0  
**Lec-Rec-Lab:** (0-2-0)  
**Semesters Offered:** Fall - Offered alternate years beginning with the 2007-2008 academic year  
**Restrictions:** May not be enrolled in one of the following Class(es): Freshman, Sophomore  
**Pre-Requisite(s):** BL 2940

EH 4211 - Exercise Physiology Laboratory
A companion course to BE4210 or BL4210. Hands-on experience in making physiological measurements as related to exercise. Cardiovascular and respiratory changes during exercise will be monitored. A virtual lab is used to simulate changes in physiological measurements that cannot be performed on live subjects. A student designed laboratory project is required.
**Credits:** 1.0  
**Lec-Rec-Lab:** (0-0-3)  
**Semesters Offered:** Fall  
**Pre-Requisite(s):** BE 4210(C) or BL 4210(C)
EH 4900 - Internship in Exercise Science
Practical and didactic training in Exercise Science in an approved internship site. Provides practical experience in instrumentation and measurement of fitness levels, and cardiopulmonary and muscular health. Internships must be approved by the department internship coordinator and work 40 hours for each credit earned.
Credits: variable to 9.0; Repeatable to a Max of 9
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of department required; May not be enrolled in one of the following Class(es): Freshman, Sophomore

EH 4990 - Special Topics in Exercise Science
Examination of current topics in the field of exercise science. Literature and research topics are addressed.
Credits: variable to 6.0; Repeatable to a Max of 6
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of instructor required; May not be enrolled in one of the following Class(es): Freshman, Sophomore

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Engineering Fundamentals

ENG 1001 - Engineering Problem Solving
Introduction to the engineering problem solving method and to modern tools used to solve problems.
Credits: 2.0
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Fall
Pre-Requisite(s): MA 1031(C) or MA 1032(C)

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, orthographic projection, object transformations, 3-D coordinate systems, patterns folding to 3-D objects, and cross sections of solids.
Credits: 1.0
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall

ENG 1003 - Introduction to Computer Aided Drafting
Fundamentals of creating engineering drawings with modern CAD software. Topics include basic geometric construction, drawing modification, dimensioning, and working with layers.
Credits: 1.0
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Spring
Pre-Requisite(s): ENG 1101 or ENG 1002 or ENG 1100

ENG 1100 - Engineering Analysis
An introduction to the engineering profession. Focuses on engineering analysis, computational skills, and communication skills.
Credits: 2.0
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Spring
Pre-Requisite(s): ENG 1001 and (MA 1160(C) or MA 1161(C) or MA 1140(C))
**ENG 1101 - Engineering Analysis and Problem Solving**
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:** (0-0-5)  
**Semesters Offered:** Fall, Spring  
**Pre-Requisite(s):** MA 1160(C) or MA 1161(C) or MA 1140(C)

**ENG 1102 - Engineering Modeling and Design**
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:** (0-0-5)  
**Semesters Offered:** Fall, Spring  
**Pre-Requisite(s):** ENG 1101 or (ENG 1001 and ENG 1100) and (MA 2160(C) or MA 2140(C) or MA 2150(C))

**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 5.0; Repeatable to a Max of 6  
**Semesters Offered:** On Demand

**ENG 2110 - Statics**
Force systems in two or 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:** (0-3-0)  
**Semesters Offered:** Fall, Spring  
**Pre-Requisite(s):** MA 2150 or MA 2160

**ENG 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 2nd moments of area. Intro 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  
**Restrictions:** May not be enrolled in one of the following Major(s): Mechanical Engineering  
**Pre-Requisite(s):** (MA 2150 or MA 2160) and PH 2100

**ENG 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 loading of circular cross sections, and flexural loading of straight members. Also covers stresses due to combined loading and buckling of columns.

**Credits:** 3.0  
**Lec-Rec-Lab:** (0-3-0)  
**Semesters Offered:** Fall, Spring  
**Pre-Requisite(s):** ENG 2110 or MEEM 2110
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 5.0; Repeatable to a Max of 6
Semesters Offered: On Demand

ENG 3000 - Engineering for Non-Believers
Everything you wanted to know about engineering but were afraid to ask. This course will take students on a journey through time investigating engineering’s greatest feats and greatest lies. Students will work in teams to uncover basic engineering principles and how basic math skills help engineers do the things they do.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following College(s): College of Engineering
Pre-Requisite(s): UN 2002(C)

ENG 3200 - Thermodynamics/Fluid Mechanics
Provides engineering students with a unified understanding of the fundamental conservation laws and property accounting applied to thermodynamic and fluid dynamic systems. Topics will include but are not limited to: ideal gas behavior; heat, work, and energy; 1st and 2nd laws of thermodynamics; heat pumps; cycles; hydrostatics; Bernoulli; pipe flow and loss; and lift and drag.
Credits: 4.0
Lec-Rec-Lab: (0-4-0)
Semesters Offered: Fall, Spring
Pre-Requisite(s): (MA 2160 or MA 2150) and (CH 1100 or CH 1110) and PH 2100

ENG 3507 - Introduction to Fluid Mechanics
Provides engineering students with a unified understanding of fluid dynamic systems. Topics will include but are not limited to hydrostatics, Bernoulli, pipe flow and loss, and lift and drag. Course offered second half of spring semester.
Credits: 2.0
Lec-Rec-Lab: (0-2-0)
Semesters Offered: Spring
Pre-Requisite(s): PH 2100 and (CH 1100 or CH 1110) and (MA 2150 or MA 2160)

ENG 3530 - Undergraduate Colloquium in Sustainability
Readings and speakers are used to teach concepts of sustainable development and global sustainability. Specific topics are derived from the industrialized and developing world.
Credits: 1.0
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Graduate

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 5.0; Repeatable to a Max of 6
Semesters Offered: On Demand
ENG 4160 - Teaching Methods in Technology and Design
Course intended for students pursuing technology and design secondary teacher certification. Students enroll in this course during the semester of their directed teaching.
Credits: 1.0
Lec-Rec-Lab: (0-0-3)
Semesters Offered: On Demand
Co-Requisite(s): ED 4710

ENG 4510 - Sustainable Futures I
Covers introductory and intermediate concepts of Sustainable Development. Explores methods/tools for assessing sustainability (economic, environmental, societal impacts) of current and emerging industrial technologies. Explores relationships between government policies and markets for introducing sustainable technologies into national economies and corporations.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): UN 2002

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. Students must be Senior Project ready as defined by major.
Credits: 3.0
Lec-Rec-Lab: (0-1-6)
Semesters Offered: Fall, Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior

ENG 4905 - Engineering Design Project
Students complete a multidisciplinary engineering design project. Students must be Senior Project ready as defined by major. Not open to students who have taken ENG4900 or ENG4910.
Credits: 3.0
Lec-Rec-Lab: (0-2-3)
Semesters Offered: On Demand
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior

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. (Senior project ready as defined by major substitutes for prerequisites)
Credits: 3.0
Lec-Rec-Lab: (0-1-6)
Semesters Offered: Fall, Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior
Pre-Requisite(s): ENG 4900

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
Semesters Offered: On Demand
Enterprise

ENT 1960 - Enterprise Orientation-Spring
An orientation for students to their specific enterprise. Covers enterprise specific topics but should also 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

ENT 2950 - Enterprise Project Work I
An orientation for students to their specific enterprise. Covers enterprise specific topics but 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
Restrictions: May not be enrolled in one of the following Class(es): Freshman

ENT 2960 - Enterprise Project Work II
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: Fall, Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): ENT 2950

ENT 2961 - Teaming in the 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: 2.0
Lec-Rec-Lab: (0-1-2)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): UN 2002(C)

ENT 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: (0-1-0)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): UN 1002 or UN 1003
ENT 2964 - Machine Tool Fundamentals and Applications
Basic machine processes including setup and operation of lathes, milling machines, drill presses, grinder and saws. Students are exposed to fundamental machining processes, nomenclature, and machine operation with an overall focus on quality control and safety.
Credits: 1.0
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall

ENT 3401 - Economic Decision Analysis I
For students who want to take EC3400 in modules. Covers interest rate calculations, loan payments, and decision- making tools including rate of return, present and annual worth, and benefit/cost ratio. Discusses project evaluation including depreciation, taxes, and cash flows. Taught in the first 10 weeks of EC 3400.
Credits: 2.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): UN 2002

ENT 3403 - Economic Decision Analysis II
For students who want to take EC3400 in modules. Provides an understanding of the setting in which effective decisions are made. Covers business organization, financial statements, risk and uncertainty, project and business financing, and capital budgeting. Taught during the third five weeks of EC3400.
Credits: 1.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): (EC 3401(C) or ENT 3401(C)) and UN 2002

ENT 3950 - 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 will practice designing approaches to solve problems and develop procedures to achieve specified project objectives.
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
Pre-Requisite(s): ENT 2960

ENT 3954 - Enterprise Market 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: (0-1-0)
Semesters Offered: Fall
Restrictions: Permission of instructor required; Must be enrolled in one of the following Class(es): Junior, Senior
ENT 3955 - Conceptual Design and Creative Problem Solving
Students gain 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 (NCIIA).
Credits: 1.0
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Fall
Pre-Requisite(s): ENT 2961

ENT 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: (0-1-0)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior

ENT 3957 - Product/Process Development I
Course provides an overview of the major activities involved in developing a product or service which will satisfy the customer. Introduces major engineering tools used for team-based integrated product/process development (IPPD) such as project management, benchmarking, quality function deployment, process flow charting, cost analysis, and failure modes and effects analysis.
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

ENT 3958 - Ethics in Engineering Design and Implementation
The focus of this course is on ethical considerations in the engineering design and implementation process. Basic ethical analysis tools will be explored through various exercises. Students will analyze and present life engineering ethics case studies.
Credits: 1.0
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): ENG 1101

ENT 3960 - Enterprise Project Work IV
Interdisciplinary teams work as part of an engineering enterprise to address real-world engineering design projects or problems. Third-year students practice designing approaches to solve problems and develop procedures to achieve specified project objectives.
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
Pre-Requisite(s): ENT 3950
ENT 3961 - 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
Pre-Requisite(s): ENT 2961 and UN 2002

ENT 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
Pre-Requisite(s): ENT 2962 and (UN 1002 or UN 1003)

ENT 3963 - Enterprise Entrepreneurship
This course emphasizes the financial, marketing, and technological challenges faced by entrepreneurs. The course will help the student learn how to establish a business plan and assess opportunistic risk for new business ventures. Alternative product and/or process innovations can be evaluated and implemented.
Credits: 1.0
Lec-Rec-Lab: (0-1-0)
Semesters Offered: On Demand
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): (ENT 2961 or BA 2700) and UN 2002 and ENT 3954

ENT 3964 - Project Management
Project definition, developing a work breakdown structure, responsibility assignment and milestone development. Covers techniques for project scheduling and practical application of Gannt 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
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior

ENT 3966 - Design for Manufacturing
This course supplements courses that address "design for function." Products "designed for manufacturing" are lower cost, higher quality, and have a shorter time to market. The course describes how the capabilities and limitations of common manufacturing processes translate into qualitative design guidelines. Topics include design for casting, forging, sheet metal forming, machining, plastics and assembly.
Credits: 1.0
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): ENG 1102
ENT 3967 - Product/Process Development II
This course provides an overview of the major activities involved in developing a product or service which will satisfy the customer. The course introduces major engineering tools used for team-based integrated product/process development (IPPD) such as cost-effective development of manufacturing processes including lean manufacturing, statistical process control, design of experiments, geometric dimensioning and tolerancing and poka-yoke (mistake proofing).

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

ENT 3969 - Project Phases of Design and Implementation
The focus of this course is on the various project phases associated with the manufacture or construction of engineering design solutions. Roles, relationships and duties of various parties and their changing activities will be explored from an overall perspective of the management of the project.

Credits: 1.0
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): ENG 1102

ENT 3970 - Enterprise Special Topics
For the development of new, junior-level instructional modules in support of the engineering enterprise.

Credits: 1.0; May be repeated
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Fall, Spring
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior

ENT 3971 - Seven Habits of Highly Effective People
Focuses on personal and professional effectiveness through greater productivity, increased influence in key relationships, stronger team unity and complete life balance. This course will explore these areas through interactive exercises, case studies, videos, and sharing of experiences.

Credits: 1.0
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior

ENT 3972 - Practical Electronic Circuit Design and Fabrication
This is a hands-on laboratory course that focuses on practical implementation of electronic circuits, especially for students enrolled in the Enterprise Program. Topics include grounding, wiring, analog/digital circuits, power supplies, EMC, board layout/fab/test, soldering, safety and instrumentation.

Credits: 1.0
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring
Restrictions: Permission of instructor required
ENT 3973 - Introduction to Geohydrological Characterization Techniques
Students will have the opportunity to conduct geohydrologic field work and apply the principles observed in the field to mathematical models. They will learn basic hygienic-oriented analytical techniques for evaluating well water. The course will require a weekend field excursion.

Credits: 1.0
Lec-Rec-Lab: (0-0-1)
Semesters Offered: Fall, Spring

ENT 3974 - Fuel Cell Fundamentals
This course provides an introduction to fuel cells and fuel cell systems. Topics include an overview of fuel cell construction, fuel cell chemistry, fuel cell losses and efficiency, and integrating fuel cells onto vehicles.

Credits: 1.0
Lec-Rec-Lab: (1-0-0)
Semesters Offered: Fall
Pre-Requisite(s): CH 1100 or CH 1110

ENT 3975 - Introduction to Vehicle Design and System Modeling
Enterprise module introduces students to vehicle design process and system modeling. Students will be shown the formulation of math based models of systems and will use MATLAB as the computing engine. Computing applications include matrixes, arrays, logical operators, program control flow, looping, iterative solutions and output manipulation including two and three dimensional graphics. The course is presented in an interactive Lecture/Computer Laboratory format. Theory is developed for each topic, demonstrated in MATLAB and example problems are solved by students using MATLAB during the period.

Credits: 1.0
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Fall
Pre-Requisite(s): ENG 1102

ENT 4950 - 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. Must be Senior Project ready as defined by major.

Credits: 2.0
Lec-Rec-Lab: (0-0-6)
Semesters Offered: Fall, Spring
Restrictions: Must be enrolled in one of the following Class(es): Senior
Pre-Requisite(s): ENT 3960

ENT 4951 - Project Budgeting and Business Planning in the Enterprise
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: Spring
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior
ENT 4952 - Complex Communication Practices
Students apply strategies and knowledge learned in ENG2962 and ENG3962 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.
Credit: 1.0
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Fall
Pre-Requisite(s): ENT 3962 and (UN 1002 or UN 1003)

ENT 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.
Credit: 1.0
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Fall
Pre-Requisite(s): ENT 2961 and UN 2002

ENT 4960 - Enterprise Project Work VI
Interdisciplinary teams work as part of an engineering enterprise to address real-world engineering design projects or problems. Fourth-year students gain experience defining project objectives, planning strategies to achieve these objectives, and leading technical teams to accomplish project goals.
Credit: 2.0
Lec-Rec-Lab: (0-0-6)
Semesters Offered: Fall, Spring
Restrictions: Must be enrolled in one of the following Class(es): Senior
Pre-Requisite(s): ENT 4950

ENT 4961 - Enterprise Project Work VII
Course intended for students who have completed all project courses in Enterprise and who wish to continue with the program through graduation.
Credit: 1.0; Repeatable to a Max of 2
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Fall, Spring
Restrictions: Permission of instructor required; Must be enrolled in one of the following Class(es): Senior
Pre-Requisite(s): ENT 4960

ENT 4970 - Enterprise Special Topics
For the development of new, senior-level instructional modules in support of the engineering enterprise.
Credit: 1.0; May be repeated
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Fall, Spring
Restrictions: Must be enrolled in one of the following Class(es): Senior
English as a Second Language

ESL 0100 - Special Topics

Credits: variable to 4.0; Graded Pass/Fail Only
Semesters Offered: On Demand

ESL 0210 - Beginning Reading/Vocabulary
For students of English as a second language; not for native speakers of English. Emphasis is on vocabulary acquisition, word form, and morpheme recognition; comprehension of main ideas, structural details, and summary; critical-thinking skills.
Credits: 4.0; May be repeated; Graded Pass/Fail Only
Lec-Rec-Lab: (0-3-3)
Semesters Offered: Fall, Spring

ESL 0220 - Beginning Writing/Grammar
For students of English as a second language; not for native speakers of English. Emphasis is on understanding sentence basics, paragraph structure, basic grammar. Students write sentences and paragraphs using present, past and future tense and participate in peer editing.
Credits: 4.0; Graded Pass/Fail Only
Lec-Rec-Lab: (0-3-3)
Semesters Offered: Fall, Spring

ESL 0230 - Beginning Listening/Speaking
For students of English as a second language; not for native speakers of English. Emphasis on basic pronunciation and listening comprehension in North American English; includes patterns of rhythm and intonation; and conversation practice.
Credits: 4.0; Graded Pass/Fail Only
Lec-Rec-Lab: (0-3-3)
Semesters Offered: Fall, Spring, Summer

ESL 0290 - Beginning Special Topics
For students of English as a second language; not for native speakers of English. Concentrated study of a specific area of ESL. Example: English for computer users.
Credits: variable to 6.0; Graded Pass/Fail Only
Semesters Offered: Fall, Spring, Summer

ESL 0310 - Intermediate Read/Vocabulary
For students of English as a second language, not for native speakers of English. Emphasis is on vocabulary acquisition, word form and morpheme recognition, comprehension of main ideas and structural details, critical-thinking skills and class discussion. Students learn to take notes, outline and summarize.
Credits: 4.0; May be repeated; Graded Pass/Fail Only
Lec-Rec-Lab: (0-3-3)
Semesters Offered: Fall, Spring

ESL 0320 - Intermediate Writing/Grammar
For students of English as a second language, not for native speakers of English. Emphasis is on writing essays using the process approach to writing and collaborative workshop approach to revision in writing academic essays.
Credits: 4.0; May be repeated; Graded Pass/Fail Only
Lec-Rec-Lab: (0-3-3)
Semesters Offered: Fall, Spring
ESL 0330 - Intermed. Listening/Speaking
For students of English as a second language; not for native speakers of English. Emphasis is on pronunciation and conversation, including rhythms, stress, and intonation; provides practice in social and academic English conversation using American culture as content.
 Credits: 4.0; Graded Pass/Fail Only
 Lec-Rec-Lab: (0-3-3)
 Semesters Offered: On Demand

ESL 0390 - Intermediate Special Topics
For students of English as a second language, not for native speakers of English. Concentrated study of a specific area of ESL in greater depth than in other courses. Examples: English for computer users, idioms. Contact Director of ESL Programs.
 Credits: variable to 4.0; May be repeated; Graded Pass/Fail Only
 Semesters Offered: On Demand

ESL 0399 - Intermediate Independent Study
For students of English as a second language, not for native speakers of English. Selected areas in ESL based on interest and need of student. Interested students should contact the Director of English as a Second Language Programs.
 Credits: variable to 6.0; May be repeated; Graded Pass/Fail Only
 Semesters Offered: On Demand

ESL 0410 - Advanced Reading/Vocabulary
For students of English as a second language, not for native speakers of English. Emphasis is on preparing students for academic study through the development of effective reading strategies, vocabulary acquisition, note-taking, inferring, summarizing, critical thinking and discussion, and understanding American culture.
 Credits: 4.0; May be repeated; Graded Pass/Fail Only
 Lec-Rec-Lab: (0-3-3)
 Semesters Offered: Fall, Spring

ESL 0420 - Advanced Writing/Grammar
For students of English as a second language, not for native speakers of English. Emphasis is on the process approach to writing, collaborative workshop approach to revision, and APA style documentation in writing academic essays and research paper.
 Credits: 4.0; May be repeated; Graded Pass/Fail Only
 Lec-Rec-Lab: (0-3-3)
 Semesters Offered: Fall, Spring

ESL 0430 - Advanced Listening/Speaking
For students of English as a second language; not for native speakers of English. Emphasis on improving pronunciation; social and academic conversation; academic presentations.
 Credits: 4.0; May be repeated; Graded Pass/Fail Only
 Lec-Rec-Lab: (0-3-3)
 Semesters Offered: Fall, Spring, Summer
 Pre-Requisite(s): ESL 0330

ESL 0490 - Advanced Special Topics
For students of English as a second language, not for native speakers of English. Concentrated study in a specific area of ESL in greater depth than in other courses. Examples: academic writing, business English. Contact Director of ESL Programs.
 Credits: variable to 4.0; May be repeated; Graded Pass/Fail Only
 Semesters Offered: On Demand
ESL 0498 - SMILE: Summer Intensive Language Experience
For students of English as a second language; not for native speakers of English. Accelerated multiple skills course on reading strategies, vocabulary acquisition, note taking, inferring, summarizing, critical thinking, class discussion, essay writing, American culture. Prepares students for academic study.
**Credits:** 8.0; Graded Pass/Fail Only
**Lec-Rec-Lab:** (0-5-3)
**Semesters Offered:** Summer

ESL 0499 - Advanced Independent Study
For students of English as a second language, not for native speakers of English. Selected areas of ESL based on student need. Interested students should contact the Director of English as a Second Language Programs.
**Credits:** variable to 6.0; May be repeated; Graded Pass/Fail Only
**Semesters Offered:** Fall, Spring

ESL 0510 - Academic Support Writing/Grammar
For students of English as a second language; not for native speakers of English. Emphasis on improving academic reading and writing skills; includes grammar, summary, paraphrase, documentation, research writing.
**Credits:** 3.0; May be repeated; Graded Pass/Fail Only
**Lec-Rec-Lab:** (0-3-0)
**Semesters Offered:** Fall, Spring, Summer
**Restrictions:** May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior
**Pre-Requisite(s):** ESL 0420

ESL 0520 - Academic Support Listening/Speaking
For students of English as a second language; not for native speakers of English. Emphasis on improving pronunciation and conversation skills; academic discussion skills; academic presentations.
**Credits:** 3.0; May be repeated; Graded Pass/Fail Only
**Lec-Rec-Lab:** (0-3-0)
**Semesters Offered:** Fall, Spring
**Restrictions:** May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior
**Pre-Requisite(s):** ESL 0430

ESL 0590 - Academic Support Spec Topics
For students of English as a second language, not for native speakers of English. Study a specific area of ESL in greater depth than in other courses. Examples: graduate/research writing, business English, academic presentations. Contact Director of ESL Programs.
**Credits:** variable to 4.0; May be repeated; Graded Pass/Fail Only
**Semesters Offered:** On Demand
**Restrictions:** May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior

ESL 0599 - Academic Support Indep Study
For students of English as a second language, not for native speakers of English. Selected areas in ESL based on student need and interest. Interested students should contact the Director of English as a Second Language Programs.
**Credits:** variable to 6.0; May be repeated; Graded Pass/Fail Only
**Semesters Offered:** Fall, Spring
Fine Arts

FA 1150 - Drawing
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 1701 - Backstage Technology
Overview of the basic techniques, theories, and terminology of technical theatre. Focus on practical application of stagecraft and rigging for a theatrical 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

FA 1702 - Lighting and Sound Technology
Overview of the basics of theatrical lighting, stage electrics, audio systems, and techniques for theatrical production. Focus on practical application of static and automated lighting for a theatrical production, including instrumentation and control. Introduction to live sound reinforcement, recording, and complex playback.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: 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, Summer

FA 2150 - Creative Drawing
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 criticize.
Credits: 3.0
Lec-Rec-Lab: (0-2-3)
Semesters Offered: Spring

FA 2200 - Watermedia I
Introduction to the unique visual and expressive possibilities inherent in the use of watermedia painting. Equal emphasis on perception, practice, and exploration. Development of basic 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
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

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, Summer

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 pep bands anywhere. Counts as 1 unit of co-curricular.

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. Counts as 1 unit of co-curricular.

Credits: 1.0; May be repeated; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Fall, Spring

FA 2420 - Jazz 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
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, Summer

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

FA 2630 - Michigan Tech Dance
Dance is a musical theatre dance class that will focus on teaching the various dance styles most commonly featured in contemporary musical theatre. The student dance company that will constitute this class will support musical theatre productions within the Department and perform dance concerts. Audition required.
**Credits:** 1.0; May be repeated  
**Lec-Rec-Lab:** (0-0-3)  
**Semesters Offered:** Fall, Spring  
**Restrictions:** Permission of instructor required

FA 2660 - Mainstage Theatre: 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  
**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  
**Semesters Offered:** Fall, Spring  
**Restrictions:** Permission of instructor required

FA 2662 - Mainstage: Sound Crew
Open to students selected for the sound crew of a mainstage 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 Sound Designer of the Department of Fine Arts.
**Credits:** variable to 3.0; May be repeated  
**Semesters Offered:** Fall, Spring  
**Restrictions:** Permission of instructor required
FA 2800 - Script Analysis
An examination of dramatic literature for the purpose of learning methods of textual analysis, including character analysis, thematic analysis, functional analysis, and plot analysis, which are important in designing theatrical productions.

Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall

FA 2821 - Performance Design Principles
An introduction to the design principles of the live entertainment industry including design needs, production methods, equipment, and facilities for various venues. Among the applications to be surveyed are theatre, concerts, theme parks, museums, and corporate events. Related career opportunities will be explored. Not open to students with credit for FA 2820.

Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: 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: variable to 3.0; May be repeated; Graded Pass/Fail Only
Semesters Offered: On Demand

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: On Demand
Pre-Requisite(s): FA 1150 or FA 2150

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
Pre-Requisite(s): FA 2200

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: (0-2-3)
Semesters Offered: Spring - Offered alternate years beginning with the 2005-2006 academic year
Pre-Requisite(s): UN 1002 or UN 1003
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: Fall, Spring - Offered alternate years beginning with the 2002-2003 academic year
Pre-Requisite(s): UN 1002 or UN 1003

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 2001-2002 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: Spring - Offered alternate years beginning with the 2003-2004 academic year
Pre-Requisite(s): UN 1002 or UN 1003

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: (0-0-3)
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: (0-0-3)
Semesters Offered: Fall, Spring
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 sight-reading. Utilizes synthesizers, computers, and music software.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): FA 2500 and (UN 1002 or UN 1003)

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: Fall, Summer
Pre-Requisite(s): UN 1002 or UN 1003

FA 3560 - Music History
Developments in Western music from antiquity to the present. Includes a brief examination of pre-Christian, medieval, and Renaissance music. Concentrates on musical development of the baroque, classical, romantic, and twentieth-century periods. Emphasizes the relationship between music expression and society, including non-Western influences.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring, Summer
Pre-Requisite(s): UN 1002 or UN 1003

FA 3650 - Production Management
Procedures and skills for effective management of theatrical productions, including coordination of performers and technicians during rehearsal and performance periods. Instruction in stage manager’s notation used for blocking, scene shifts, and cues for lighting, sound, special effects, and performers.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2005-2006 academic year
Pre-Requisite(s): FA 1701 and FA 1702

FA 3661 - Mainstage Theatre: Management and Design
Open to students who take significant responsibility for aspects of major Fine Arts theatre production, such as stage manager, assistant designer, or assistant director. Required for the minor in Technical Theatre.
Credits: variable to 3.0; May be repeated
Semesters Offered: Fall, Spring
Restrictions: Permission of instructor required
FA 3662 - Mainstage: Sound Design
Open to students who take significant responsibility for sound on major a Fine Arts production, such as sound designer, recording engineer, live sound engineer.
Credits: variable to 3.0; May be repeated
Semesters Offered: Fall, Spring
Restrictions: Permission of instructor required

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 3700 - Scenic Design
Introduction to designing theatrical scenery through various design projects. Students are involved with a mainstage theatre design. Focus on practical design presentation techniques, specific drafting conventions for theatrical designs, designer/director 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 2000-2001 academic year
Pre-Requisite(s): FA 1701

FA 3730 - Sound Design
Introduction to designing sound through design projects. Focuses on fundamental technical understanding, practical design presentation techniques, specific drafting conventions, exploration of sound equipment, designer/ director/artist relationships, script analysis and design concepts, and design history.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): UN 1002 or UN 1003

FA 3731 - Audio Creative Lab I
A creative lab for students interested in the aural arts. Students will be challenged to create sound designs and compositions in response to various aesthetic, dramatic, and philosophical goals for radio, multimedia, and live performance.
Credits: 1.0
Lec-Rec-Lab: (0-0-1)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): FA 1702 and FA 3730
FA 3732 - Audio Creative Lab II
A creative lab for students interested in the aural arts. Students will be challenged to create sound designs and compositions in response to various aesthetic, dramatic, and philosophical goals for radio, multimedia, and live performance. Note: FA3731 and FA3732 cover different projects and can be taken independently of one another.

Credits: 1.0
Lec-Rec-Lab: (0-0-1)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): FA 1702 and FA 3730

FA 3740 - Recording
Hands-on learning in the art of the recording engineer. Students develop an understanding of pop and classical recording approaches, skills to decide which approach is appropriate for a given task, and the technical knowledge necessary to implement the chosen approach.

Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2006-2007 academic year
Pre-Requisite(s): FA 3730 and FA 1702

FA 3750 - Lighting Design
Introduction to designing theatrical lighting through various design projects. Students are involved with a mainstage theatre design. Focuses on practical design presentation techniques, specific drafting conventions for theatrical designs, exploration of lighting equipment, designer/director relationships, script analysis and design concepts, and design history.

Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2005-2006 academic year
Pre-Requisite(s): FA 1702

FA 3760 - Costume Design
Introduction to designing theatrical costumes through various design projects. Students will be involved with a mainstage theatre production. Focus on practical design presentation techniques, designer/director relationships, script analysis and design concepts, pattern drafting, draping, color analyses.

Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall - Offered alternate years beginning with the 2003-2004 academic year
Pre-Requisite(s): FA 1701

FA 3780 - Directing for Theatre
A comprehensive, in-depth study of mounting a theatre production with an emphasis on directing. Through script analysis, students study the necessary production elements, how they interrelate, and directing techniques to create a unified production from the director’s vision.

Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Pre-Requisite(s): FA 2821 and (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 - Offered alternate years beginning with the 2005-2006 academic year  
**Pre-Requisite(s):** UN 1002 or UN 1003

**FA 3821 - Modern Theatre History**
Examination of American and European theatre history from the 1700s to modern times. An emphasis on the interrelationships among technology and theatre space, design and drama, and how culture and society affected style.

**Credits:** 3.0  
**Lec-Rec-Lab:** (0-3-0)  
**Semesters Offered:** Spring - Offered alternate years beginning with the 2006-2007 academic year  
**Pre-Requisite(s):** UN 1002 or UN 1003

**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:** Summer  
**Pre-Requisite(s):** 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  
**Semesters Offered:** Fall, Spring  
**Restrictions:** Permission of instructor required  
**Pre-Requisite(s):** FA 2150

**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  
**Semesters Offered:** Fall, Spring  
**Restrictions:** Permission of instructor required  
**Pre-Requisite(s):** FA 3200

**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  
**Semesters Offered:** Fall - Offered alternate years beginning with the 2005-2006 academic year  
**Restrictions:** Permission of instructor required  
**Pre-Requisite(s):** FA 3333
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
Restrictions: Permission of instructor required

FA 4420 - Music Performance: Jazz
Jazz combos (e.g., Jaztec, Salsa Norte) are select small groups of musicians studying jazz improvisation and performing literature for the 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
Semesters Offered: Fall, Spring
Restrictions: Permission of instructor required

FA 4510 - Special Topics - Advanced Sound Studio
Introduction to professional sound work. Students produce a professional product in studio or live sound. Emphasis is placed on solid engineering practice and documentation to produce a desired artistic goal developed with the artistic performers, producers, or users.
Credits: variable to 6.0; Repeatable to a Max of 12
Semesters Offered: Fall, Spring
Restrictions: Permission of instructor required
Pre-Requisite(s): FA 3730 and FA 1702

FA 4730 - Advanced Sound Design
A study of the musicality of noise and texts and their integration in theatrical sound design, mixing, and mastering. Emphasis is on student creativity and critical listening. Develops further applications of artistic concepts introduced in FA 3730.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall - Offered alternate years beginning with the 2006-2007 academic year
Pre-Requisite(s): FA 3730 and FA 1702

FA 4740 - Transducer Theory
In depth study of Microphone and Loudspeaker design as it applies to usage in recording and live sound reinforcement with an emphasis on interaction with the acoustical environmental.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Summer - Offered alternate years beginning with the 2005-2006 academic year
Pre-Requisite(s): FA 3730 and FA 1702

FA 4750 - Advanced Lighting Design
Studies of the visual results of lighting in a variety of environments including theatrical, architectural, and industrial. Expansion of artistic concepts introduced in FA 3750. Explores various types of lighting equipment, control systems, reflectant and absorbant surfaces, and color mixing in light.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall - Offered alternate years beginning with the 2006-2007 academic year
Pre-Requisite(s): FA 3750
FA 4800 - Jazz Improvisation  
Explores the elements of jazz improvisation while developing creative ideas and technical facility in the individual musician. Emphasis will be placed on learning the idiomatic use of the major scale and associated modes, the jazz melodic minor scale, the blues scale, pentatonic scales, and the 8-tone dominant scale. Development of stylistic conformity by exploring the styles of swing, bebop, cool, blues, Latin and rock/funk. Emphasis on the II-V-I progression in major and minor keys and symmetric harmony.  
**Credits:** 3.0  
**Lec-Rec-Lab:** (0-3-0)  
**Semesters Offered:** On Demand - Offered alternate years beginning with the 2001-2002 academic year  
**Pre-Requisite(s):** FA 3530 and (UN 1002 or UN 1003)

FA 4820 - Jazz Arranging  
Explores elements of jazz arranging and composition while developing creative ideas in the individual musician. Emphasis on learning to arrange for jazz combo and traditional big band. Includes developing the shape concept of triad use, 4-part and 5-part chord voicing, construction of an arrangement, and competence with FINALE notational software.  
**Credits:** 3.0  
**Lec-Rec-Lab:** (0-3-0)  
**Semesters Offered:** Spring - Offered alternate years beginning with the 2003-2004 academic year  
**Pre-Requisite(s):** FA 2500 and FA 3530

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  
**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  
**Semesters Offered:** Fall, Spring, Summer  
**Restrictions:** Permission of instructor required

FA 4915 - Independent Study with CAML Access  
Allows students to use the Fine Arts (CAML) Computer Lab while engaged in an independent study project supervised by a Fine Arts Department faculty member.  
**Credits:** variable to 3.0; May be repeated  
**Semesters Offered:** Fall, Spring, Summer  
**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  
**Semesters Offered:** Fall, Spring, Summer  
**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
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of instructor required

FA 4970 - Fine Arts Final Project
Capstone course extending the student's knowledge and skill in a chosen fine arts discipline through independent research or other focused creative activity. A detailed proposal of the student's final project must be approved in writing by a Fine Arts faculty advisor before the student enrolls in FA4970.
Credits: variable to 3.0
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of instructor required; May not be enrolled in one of the following Class(es): Freshman, Sophomore

FA 4971 - Fine Arts Final Project with Computer Lab Access
Capstone course extending the student's knowledge and skill in a chosen fine arts discipline through independent research or other focused creative activity utilizing the Fine Arts Computer Lab. A detailed proposal of the student's final project must be approved in writing by a Fine Arts faculty advisor before student enrolls in FA4971.
Credits: variable to 3.0; May be repeated
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of instructor required

FA 4972 - Fine Arts Final Project with Sound Studio Access
Capstone course extending the student's knowledge and skill in a chosen fine arts discipline through independent research or other focused creative activity utilizing the Fine Arts Sound Studio. A detailed proposal of the student's final project must be approved in writing by a Fine Arts faculty advisor before the student enrolls in FA4972.
Credits: variable to 3.0; Repeatable to a Max of 6
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of instructor required; May not be enrolled in one of the following Class(es): Freshman, Sophomore

FA 4975 - Portfolio Presentation
A public presentation of an array of art work completed by a student, required as part of the minor in Art. Guidelines for the portfolio presentation are available from the student's advisor for the minor in Art.
Credits: variable to 3.0; Repeatable to a Max of 3
Semesters Offered: Fall, Spring
Restrictions: Permission of instructor required
Forest Resources & Env Science

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 fields within forestry, conservation and ecology that represent specialties within natural resources.
Credits: 1.0
Lec-Rec-Lab: (1-0-0)
Semesters Offered: Spring

FW 2010 - Vegetation of North America
Identification of trees and shrubs. Study of seed dispersal, dormancy, seedbed requirements, shade tolerance, life span, and ecology, with an emphasis on trees. Systematic study of the major forested vegetation types of North America.
Credits: 4.0
Lec-Rec-Lab: (2-1-3)
Semesters Offered: Fall

FW 2020 - Basic Ecology Field Skills
Basic field techniques for identifying forest plant species, quantifying their size and abundance, summarizing field data, and presenting results.
Credits: 1.0
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall
Restrictions: Permission of department required

FW 2050 - Measuring Forest Resources
Introduction to the techniques used to measure and evaluate forest ecosystems. Includes land measurement, field use of maps and air photos, vegetation measurement, habitat classification, estimation of tree volume and biomass, sampling designs, basic descriptive statistics, and the use of computers for summarizing and presenting data.
Credits: 3.0
Lec-Rec-Lab: (2-0-3)
Semesters Offered: Fall

FW 2051 - Field Techniques
Equipment and techniques used to measure forest ecosystem attributes and perform fieldwork. Topics include field safety, land measurement and navigation, establishment of sample locations, measurement of attributes of individuals and groups of trees, vegetation and other organisms.
Credits: 1.0
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Fall
FW 3010 - Practice of Silviculture
Methods of controlling the establishment, growth, composition, health and quality of forests and woodlands to meet the diverse needs and values of landowners and society on a sustainable basis.
Credits: 4.0
Lec-Rec-Lab: (2-1-3)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Major(s): Forestry
Pre-Requisite(s): FW 2010 and FW 2050

FW 3012 - Survey of Silviculture
An introduction to the practice of silviculture including ecological principles which form the basis for forest management. The course emphasizes proper use of silviculture terminology and includes field examples of management practices.
Credits: 1.0
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Major(s): Wildlife Ecology & Mgmt, App Ecol & Environ Sci
Pre-Requisite(s): FW 2010 and FW 2050

FW 3020 - Forest and Landscape Ecology
Gain a basic understanding of how forest ecosystems 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
Pre-Requisite(s): FW 2010(C) and FW 2050(C)

FW 3075 - Introduction to Biotechnology
Basic concepts and practical applications of biotechnology and genetic engineering. Topics include advances and practical applications relating to improving quality and field performance of agricultural crops, environmental remediation, and phyto-pharmaceutics. Recent advances in gene containment, regulatory, societal and environmental issues associated with commercialization of genetically modified organisms will be discussed.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring

FW 3098 - Wood Processing and Manufacture
A huge variety of products are manufactured from wood. Wood-based manufacturing plants in the upper Midwest are visited during the week prior to the start of the fall semester. Plant similarities and differences are discussed during class meetings.
Credits: 2.0
Lec-Rec-Lab: (1-0-3)
Semesters Offered: Fall
Pre-Requisite(s): FW 1035
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 policymaking 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
Pre-Requisite(s): UN 2002(C)

FW 3150 - Timber Harvesting
Methods and techniques used in timber harvesting systems. Emphasizes best management practices, aesthetic and ecological impacts, logging cost analysis, timber appraisal, and timber sale preparation and administration.
Credits: 2.0
Lec-Rec-Lab: (1-0-3)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Major(s): Forestry
Pre-Requisite(s): FW 2050

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: 1.0
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Major(s): Wildlife Ecology & Mgmt, App Ecol & Environ Sci, Forestry
Co-Requisite(s): FW 3190
Pre-Requisite(s): FW 3540

FW 3180 - Geomorphology, Landscapes and Ecosystems
Provides basic understanding of the geologic and glacial processes that shaped the landscape of the Upper Midwest influencing the distribution and productivity of modern-day plant communities. Topics include geology of Michigan, glacial geomorphology, soil development, landscape and community ecology, and forestry.
Credits: 2.0
Lec-Rec-Lab: (1-0-3)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Major(s): Wildlife Ecology & Mgmt, App Ecol & Environ Sci; May not be enrolled in one of the following Class(es): Freshman

FW 3190 - Multi-resource 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: 3.0
Lec-Rec-Lab: (0-1-4)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Major(s): Wildlife Ecology & Mgmt, App Ecol & Environ Sci, Forestry
Pre-Requisite(s): FW 2050 and FW 3020 and (MA 2720 or MA 2710 or MA 3710)
FW 3200 - Inventory, Monitoring and Data Analysis
Sampling design, implementation and analysis for inventory and monitoring of attributes of stands, forests and landscapes. Includes computing skills for data entry, storage and analysis and application of statistical techniques to answer questions about ecological data.
Credits: 4.0
Lec-Rec-Lab: (3-0-3)
Semesters Offered: Spring
Pre-Requisite(s): (FW 2050 or FW 2051) and (MA 2710 or MA 2720 or MA 3710)

FW 3300 - Introduction to Genomics
Introduction to Genomics. Genome organization, mapping and characterization from humans and related organisms. Topics include hierarchical arrangement of genes, genome mapping, molecular markers of physical genome maps, genome sequencing, comparative genomics, analysis of important human genes and their products, and ethical and legal aspects of genomics.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): BL 2200

FW 3330 - Soil Science
Introduction to the chemical, physical, and biological properties of soil.
Credits: 4.0
Lec-Rec-Lab: (3-0-3)
Semesters Offered: Fall
Pre-Requisite(s): CH 1100(C) or CH 1110(C)

FW 3376 - Forest & Environmental Resource Management (The FERM)
Application of forest and environmental management practices by teams of students with the assistance of faculty, staff and representatives of state, federal and corporate land management groups as well as non-governmental organizations.
Credits: variable to 4.0
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of instructor required
Pre-Requisite(s): FW 2010(C) and FW 2050(C)

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 biological resources.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Pre-Requisite(s): UN 2002
FW 3540 - An Introduction to Geographic Information Systems for Natural Resource Management
The fundamentals of GIS and its application to natural resource management. Spatial data, its uses and limitations are evaluated. Students work extensively with the ArcView and the ArcMap software packages.
Credits: 4.0
Lec-Rec-Lab: (0-3-3)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Major(s): App Ecol & Environ Sci, Forestry
Pre-Requisite(s): MA 2720(C) or MA 2710(C) or MA 3710(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)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Major(s): Forestry; May not be enrolled in one of the following Class(es): Freshman

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)
Semesters Offered: Spring
Pre-Requisite(s): BL 1040

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)
Semesters Offered: Summer

FW 3630 - Wildlife Habitat and Population Ecology
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. Includes an introduction to common mathematical models used in population ecology.
Credits: 4.0
Lec-Rec-Lab: (2-1-3)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following College(s): Sch of Forest Res & Envir Sci; Must be enrolled in one of the following Major(s): Wildlife Ecology & Mgmt, App Ecol & Environ Sci; May not be enrolled in one of the following Class(es): Freshman
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
**Pre-Requisite(s):** UN 2002

FW 3800 - Insect Ecology
Insects are widespread and diverse components of terrestrial and aquatic ecosystems. This course will consider aspects of insect ecology, including biodiversity and conservation of insects, the effects of biotic and abiotic factors on insect populations, and the trophic diversity of insects.
**Credits:** 2.0
**Lec-Rec-Lab:** (1-1-0)
**Semesters Offered:** Fall
**Restrictions:** Must be enrolled in one of the following Major(s): Wildlife Ecology & Mgmt, App Ecol & Environ Sci

FW 3840 - Forest Health
Drawing on examples from the Great Lakes region, and other parts of North America, this course will consider which type of insects and pathogens attack our trees and forests, how they interact with each other, and what tools we can use to effectively reduce their negative impacts of forest pests.
**Credits:** 3.0
**Lec-Rec-Lab:** (1-1-3)
**Semesters Offered:** Fall
**Restrictions:** Must be enrolled in one of the following Major(s): Wildlife Ecology & Mgmt, App Ecol & Environ Sci, Forestry
**Pre-Requisite(s):** FW 3020

FW 4080 - Forest Economics and Finance
Financial analysis and economic theory applied to forestry project analysis and selection, focusing on prices. Covers risk, regional economics, taxation, auctions, and non-market valuation. Use operations research and statistical methods to solve problems.
**Credits:** 3.0
**Lec-Rec-Lab:** (2-0-2)
**Semesters Offered:** Spring
**Restrictions:** May not be enrolled in one of the following Class(es): Freshman

FW 4087 - Molecular Genetics of Trees
Covers tree genome organization, structure, and function relationship of genes from trees; genome mapping using various techniques, such as RFLP, 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)
**Semesters Offered:** Spring
**Restrictions:** May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior
FW 4089 - 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: (2-0-2)
Semesters Offered: Spring - Offered alternate years beginning with the 2005-2006 academic year
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore

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 culture, such as media preparation, pest management, and fertilization.
Credits: variable to 4.0
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore

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)
Semesters Offered: Spring

FW 4130 - Biometrics
Application of statistical and mathematical methods to ecological issues. Subjects include exploratory data analysis, monitoring programs and development of prediction equations.
Credits: 2.0
Lec-Rec-Lab: (3-0-3)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): MA 2720 or MA 2710 or MA 3710

FW 4140 - Vegetation Modeling
Use of models in research and management of terrestrial ecosystems. Teaches application with emphasis on philosophy; models as tools, design goals and approaches, and interpreting the meaning and significance of model outputs.
Credits: 2.0
Lec-Rec-Lab: (3-0-3)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Co-Requisite(s): FW 4130
Pre-Requisite(s): MA 2720 or MA 2710 or MA 3710
FW 4150 - Forest Resource 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)  
Semesters Offered: Fall  
Pre-Requisite(s): FW 3010 and FW 4080

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)  
Semesters Offered: Fall  
Pre-Requisite(s): 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)  
Semesters Offered: Fall  
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore  
Pre-Requisite(s): BL 1040

FW 4260 - Population Ecology
Covers the principles of population ecology. Topics include measures of populations, population dynamics, and models used to describe the theories related to population dynamics.

Credits: 3.0  
Lec-Rec-Lab: (3-0-0)  
Semesters Offered: Spring

FW 4300 - Introduction to Wildland Fire
An introduction to wildland fire based on an understanding of fuel properties, fire behavior, ecological effects and management.

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, Sophomore  
Pre-Requisite(s): FW 3020 and (FW 3010 or FW 3012)

FW 4370 - Forest and Landscape Hydrology
Covers the functions of water in the landscape. Emphasizes how forests affect water functions and how water functions change in the landscape due to land use.

Credits: 3.0  
Lec-Rec-Lab: (3-0-0)  
Semesters Offered: Spring
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 line clearance. Labs include experience in tree climbing, pruning, and planting.

Credits: 3.0
Lec-Rec-Lab: (2-0-3)
Semesters 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 7
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of instructor required

FW 4540 - Remote Sensing of the Environment
Overview of remote sensing principles and concepts. Topics include camera and digital sensor arrays, various types of imagery, structure of digital data, spectral reflectance curves, applications/case studies and introduction to digital image processing.

Credits: 3.0
Lec-Rec-Lab: (2-1-0)
Semesters Offered: Fall - Offered alternate years beginning with the 2006-2007 academic year
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore

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: (3-0-0)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): BL 3400(C)

FW 4630 - 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 at off campus field sites.

Credits: 6.0
Lec-Rec-Lab: (0-3-9)
Semesters Offered: On Demand
Restrictions: Permission of department required; May not be enrolled in one of the following Class(es): Freshman

FW 4632 - Southwest Field Ecology Camp
An intense field-based course in research methods. Introduces the process of ecological science from initial questions to data collection to assessing results. Trip to off-campus field sites. Course begins weekends in November and ends in January.

Credits: 6.0
Lec-Rec-Lab: (0-3-9)
Semesters Offered: On Demand
Restrictions: Permission of department required; May not be enrolled in one of the following Class(es): Freshman
FW 4634 - Cons. Issues in Yellowstone
Yellowstone has a rich, complex history of conservation challenges. This course will provide in-depth explorations of conservation controversies occurring in Yellowstone, first in a MTU classroom, followed by a week-long visit to the park. Course takes place mid-July through mid-August.
Credits: 6.0
Lec-Rec-Lab: (0-3-9)
Semesters Offered: Summer
Restrictions: Permission of department required

FW 4750 - Forest Diseases and Fungal Ecology
This course provides an understanding of fungi as essential components of forest ecosystems by examining both their disease-causing and beneficial roles. Students will develop the principles of fungus identification and diagnosis of diseases of trees caused by fungi and other organisms by using the specimens in the field and lab.
Credits: 3.0
Lec-Rec-Lab: (2-0-3)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): FW 3020

FW 4810 - Integrated Resource Assessment
Provides a capstone experience by integrating techniques from many of the applied ecology and forestry core courses. Covers multi-resource inventory of forested landscapes; description and evaluation of the potential for providing various natural resource outputs; development of GIS information and applications, maps, and other descriptors useful in the analysis of diverse management alternatives.
Credits: 4.0
Lec-Rec-Lab: (0-3-3)
Semesters Offered: Fall
Pre-Requisite(s): FW 3510 and FW 3020 and (FW 3190 or FW 3410)

FW 4850 - Environmental Education Methods
This course will prepare students to design and conduct environmental education programs for adults and youth in classrooms, parks, museums, nature centers, and through statewide outreach programs using a variety of teaching methods, hands-on activities, and scientific investigations.
Credits: 4.0
Lec-Rec-Lab: (2-1-1)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Geolog. & Mining Engrg & Sci.

GE 1100 - Geological Engineering and Sciences Orientation
Introduction to geosciences as a profession, including discussions of career opportunities and geoscience programs. Earth materials and the earth’s processes are also introduced. Includes frequent field trips. Intended for freshman or sophomore students in geological engineering, geology, applied geophysics, hydrology, geotechnics, earth science teaching, or any other geoscience program.
Credits: 1.0; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Major(s): Applied Geophysics, Geological Engineering, Geology, Engineering Undeclared, General Sciences and Arts, Sciences & Arts Undeclared; May not be enrolled in one of the following Class(es): Junior, Senior

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, landslides, groundwater, streams, shorelines, deserts, glaciers, geologic structures, earthquakes, plate tectonics, and the dynamics of the earth’s crust, mantle, and core.
Credits: 3.0
Lec-Rec-Lab: (2-0-3)
Semesters Offered: Fall, Spring, Summer

GE 2020 - Introduction to Mining Engineering and Mining Methods
Learn how various mining components, from prospecting to financing to reclamation, fit together. Includes advantages and drawbacks of different mining methods and their selection. Introduces ethics and professional development. Use of basic computer and mine design software.
Credits: 4.0
Lec-Rec-Lab: (4-0-0)
Semesters Offered: Fall - Offered alternate years beginning with the 2005-2006 academic year

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 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. GE 2300 recommended but not required.

Credits: 3.0
Lec-Rec-Lab: (2-0-3)
Semesters Offered: Spring
Pre-Requisite(s): GE 2000

GE 2350 - Structural Geology I
Rock structures resulting from the application of deforming forces, including elementary concepts of stress and strain, and the geometry of folds, foliations, lineations, faults, and joints.

Credits: 2.0
Lec-Rec-Lab: (1-0-2)
Semesters Offered: Fall
Pre-Requisite(s): GE 2000

GE 2500 - 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 2640 - Atmospheric Observations and Meteorology
Introduction to fundamentals of atmospheric science and meteorology through direct observations of the atmosphere.

Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall - Offered alternate years beginning with the 2002-2003 academic year

GE 2700 - Ore Deposit Formation
Identification, geological setting, and origin of the major types of mineral resources.

Credits: 1.0
Lec-Rec-Lab: (1-0-0)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Major(s): Mining Engineering
Pre-Requisite(s): GE 2000

GE 2800 - Water and Society
The course introduces basic concepts of the water cycle, human interactions in the water cycle, and the social and political dimensions of water. Areas of coverage include: hydrology, water economics, water law, water and politics, water and religion, and water and health.

Credits: 3.0
Lec-Rec-Lab: (2-0-2)
Semesters Offered: Fall
Pre-Requisite(s): UN 2002
GE 2900 - Geology of the National Parks: Field Experience
Two-week, field-based course taught in national parks 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. Lab fee costs dependent on location.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Summer
Restrictions: Permission of instructor required

GE 3000 - Structural Geology II
Processes and regional settings associated with structure in deformed rock. Topics include stress and strain, origin of foliations, mechanics of folding and faulting, and structures in orogenic belts
Credits: 2.0
Lec-Rec-Lab: (1-0-2)
Semesters Offered: Spring
Pre-Requisite(s): GE 2350

GE 3040 - Fundamentals of Applied and Environmental Geophysics
An introduction to geophysical used in applied and environmental geophysics concentrating on the fundamentals of data reduction and interpretation. This course is not only pertinent 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 substance.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Pre-Requisite(s): PH 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: 3.0
Lec-Rec-Lab: (2-0-3)
Semesters Offered: Fall
Pre-Requisite(s): GE 2000 and GE 2310

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: Fall
Pre-Requisite(s): CH 1100 or CH 1110

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: Fall, Spring
Pre-Requisite(s): GE 2000 or GE 2100
GE 3400 - Drilling and Blasting
Rock penetration and fragmentation methods to include boring, cutting, drilling, and blasting techniques. Design of surface and underground blasting rounds. Formulation of design criteria to minimize the adverse effects of blasting. Field demonstration in the design, monitoring, and evaluation of blasts.
Credits: 3.0
Lec-Rec-Lab: (2-0-2)
Semesters Offered: Fall - Offered alternate years beginning with the 2006-2007 academic year
Pre-Requisite(s): GE 2020 and PH 2100

GE 3410 - Mine Safety & Health Cert
Principles of health and safety in mine practice, hazard recognition, and preventive and corrective actions.
Credits: 1.0
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Summer

GE 3820 - Mechanics of Rock Materials
Analysis of stress and strain in rock for scientists and engineers. Topics range from Mohr circles for stress, incremental strain and finite strain through stress and strain tensors, and constitutive equations, with applications in structural geology, tectonics, and rock slope stability. Previous coursework in tensors not required. Not open to students who have credit for MEEM2150 or ENG2150.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Pre-Requisite(s): (MA 1135 or MA 1140 or MA 1150 or MA 1151 or MA 1160 or MA 1161) and GE 2000

GE 3850 - 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: Fall, 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: (0-0-15)
Semesters Offered: Summer
Restrictions: Permission of department required
Pre-Requisite(s): GE 3040
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 geological and/or engineering report and memo writing.
Credits: 5.0
Lec-Rec-Lab: (0-0-15)
Semesters Offered: Summer
Restrictions: Permission of department required
Pre-Requisite(s): GE 2000 and GE 2310 and GE 2350

GE 3915 - Introduction to Field Geology
An introduction to geologic field mapping and site investigations. Requires geological and/or engineering report and memo writing.
Credits: 3.0
Lec-Rec-Lab: (0-0-9)
Semesters Offered: Summer
Restrictions: May not be enrolled in one of the following Major(s): Applied Geophysics, Geological Engineering
Pre-Requisite(s): GE 2000 and GE 2310 and GE 2350

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 Max of 6
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 Max of 3
Semesters Offered: On Demand

GE 4050 - Advanced Structural Geology
How rocks deform on a microscopic to hand specimen scale. Topics include dislocations, work hardening and recovery processes, annealing and recrystallization, slipsystems, preferred orientation mechanisms, and foliation development.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: On Demand
Pre-Requisite(s): 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 - Offered alternate years beginning with the 2003-2004 academic year
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): GE 2000
GE 4150 - Natural Hazards
This course focuses on current mitigation agencies and warning systems, case studies of successes and failures in hazard mitigation, and technical tools for hazard study and mitigation such as satellite remote sensing and GIS.

Credits: 3.0  
Lec-Rec-Lab: (2-0-3)  
Semesters Offered: Fall  
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore  
Pre-Requisite(s): (GE 2000 or GE 2100) and UN 2002

GE 4210 - Mine Environmental Engineering
Topics include environmental problems and causes, regulations and methods to prevent or solve environmental problems (including gas emissions and dust monitoring and control), processing and discharging water treatment and unit operations, solid waste utilization and landfilling, and land remediation and reclamation.

Credits: 2.0  
Lec-Rec-Lab: (2-0-0)  
Semesters Offered: On Demand  
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore  
Pre-Requisite(s): CH 1100 or (CH 1110 and CH 1111)

GE 4250 - Fundamentals of Remote Sensing
This course focuses on the basic physics behind above-surface remote sensing and remote sensing systems. Topics covered include: properties of the atmosphere, absorption and scattering of electromagnetic radiation, instrument design, data acquisition and processing, validation, and basic applications.

Credits: 3.0  
Lec-Rec-Lab: (2-1-0)  
Semesters Offered: Spring  
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore  
Pre-Requisite(s): PH 2200 and (MA 2150 or MA 2160)

GE 4360 - Materials Handling
Surface and underground materials handling methods. Selection and performance analysis of materials handling equipment. Computer applications.

Credits: 3.0  
Lec-Rec-Lab: (3-0-0)  
Semesters Offered: On Demand  
Pre-Requisite(s): PH 2100

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: (2-0-1)  
Semesters Offered: Fall  
Pre-Requisite(s): PH 2200
GE 4405 - Geophysics for Archaeology
Principles and practice of non-invasive archaeological geophysics (remote sensing) such as magnetometry, ground penetrating radar and resistivity. Data interpretation will involve basic computation, contouring, 3-D visualization programs, interpretation and archaeological significance. Activities include fieldwork, data analysis and presentation, and short reports. Mathematical content is minimal.
Credits: 3.0
Lec-Rec-Lab: (2-0-1)
Semesters Offered: Fall - Offered alternate years beginning with the 2003-2004 academic year

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: (2-0-1)
Semesters Offered: Spring
Pre-Requisite(s): PH 2200 and GE 3040

GE 4415 - Matlab for Geosciences
Matlab programming as applied to graphing single and multiple one-dimensional data sets, contouring two-dimensional data sets, slice and movie presentations of three-dimensional data sets, loading data, convolution, cross and autocorrelation and frequency analysis, specialized computations for geophysics and geology.
Credits: 3.0
Lec-Rec-Lab: (2-0-1)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Major(s): Applied Geophysics, Geological Engineering, Geology; May not be enrolled in one of the following Class(es): Freshman, Sophomore

GE 4500 - Plate Tectonics and Global Geophysics
Plate tectonics and the internal structure of the earth using information from seismology, geomagnetism, gravity, and heat flow.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): (MA 3150 or MA 3160) and PH 2200 and GE 2000

GE 4550 - Gravity and Magnetic Interpretation Methods
Interpretation of gravity and magnetic anomalies based on forward modeling techniques, including space filtering to enhance anomalies of importance. Emphasis will also be given to the design of the gravity/magnetic survey based on cost, implementation, and interpretation methods used.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2004-2005 academic year
Pre-Requisite(s): GE 3040

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
Pre-Requisite(s): GE 3040
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: Fall, Spring

GE 4630 - 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, Spring
Pre-Requisite(s): (EC 3001 or EC 2002 or EC 2003) and UN 2002

GE 4750 - Structural Evaluation of Petroleum Prospects
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: (2-0-3)
Semesters Offered: Fall
Pre-Requisite(s): 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
Pre-Requisite(s): GE 2310 and GE 3000

GE 4800 - Groundwater Engineering
Application of geohydrology principles to design water-well supplies, site investigations, and subsurface remediation systems.
Credits: 3.0
Lec-Rec-Lab: (0-2-3)
Semesters Offered: On Demand
Pre-Requisite(s): 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. (Senior project ready as defined by major substitutes for prerequisites)
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, Sophomore, Junior
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. (Senior project ready as defined by major substitutes for prerequisites)
**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, Sophomore, Junior
**Pre-Requisite(s):** GE 4900

GE 4915 - Field Geology Excursions in Michigan's Upper Peninsula
Three week course which provides background necessary to understand several field sites visited as part of course. Participants are encouraged to lead other groups, particularly school groups, on visits to these sites as part of their own teaching activities.
**Credits:** 3.0
**Lec-Rec-Lab:** (0-0-9)
**Semesters Offered:** Summer

GE 4918 - Geology and Field Excursion to Canada Preparation
The geology of Canada is awesome and spectacular. This course prepares the students for the trip in terms of logistics and overviews of the geology of each location that will be visited. Students may retake class for different locations.
**Credits:** 1.0; May be repeated
**Lec-Rec-Lab:** (1-0-0)
**Semesters Offered:** Spring

GE 4919 - Geology and Field Excursion to Canada
The geology of Canada is visited on this 28 day field excursion via van and camping. Canada's geology offers spectacular study opportunities and provides a true field based experience. Students may retake class for different locations.
**Credits:** 3.0; Repeatable to a Max of 9
**Lec-Rec-Lab:** (0-0-9)
**Semesters Offered:** Summer
**Restrictions:** Permission of instructor required
**Pre-Requisite(s):** GE 4918

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:** May not be enrolled in one of the following Class(es): Freshman, Sophomore

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:** May not be enrolled in one of the following Class(es): Freshman, Sophomore
GE 4922 - Geophysics Seminar
Semiannual 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: May not be enrolled in one of the following Class(es): Freshman, Sophomore

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
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
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 6
Semesters Offered: On Demand
Restrictions: Permission of instructor required
Pre-Requisite(s): 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
Semesters Offered: On Demand
Restrictions: Permission of instructor required

GE 4934 - Special Topics in Mining Engineering
Study and discussion of topics in mining engineering not included in regular undergraduate courses.
Credits: variable to 3.0; Repeatable to a Max of 9
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
Semesters Offered: On Demand
Restrictions: Permission of instructor required; May not be enrolled in one of the following Class(es): Freshman, Sophomore

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
Semesters Offered: On Demand
Restrictions: Permission of instructor required; May not be enrolled in one of the following Class(es): Freshman, Sophomore
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
Semesters Offered: On Demand
Restrictions: Permission of instructor required; May not be enrolled in one of the following Class(es): Freshman, Sophomore

GE 4963 - Independent Mining Engineering Research Project
Approved literature, laboratory, and/or field research in mining engineering, 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
Semesters Offered: On Demand
Restrictions: Permission of instructor required; May not be enrolled in one of the following Class(es): Freshman, Sophomore

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Humanities

HU 0110 - Development of Academic Literacy Skills
Scheduled weekly appointments with a writing coach to improve writing and reading effectiveness in any course except Perspectives, World Cultures, or Revisions. (For coaching in these courses, see HU0121, 0122, 0123). Specialized assistance available to students who speak English as a Second Language and students who have learning disabilities. Credits do not count toward graduation.
Credits: 0.0; May be repeated
Semesters Offered: Fall, Spring, Summer

HU 0121 - Perspectives Coaching
Scheduled weekly appointment with a writing coach to improve writing, speaking, and reading effectiveness in Perspectives (UN1001). Strongly recommended for students with English ACT of 20 or below. Credits do not count toward graduation.
Credits: 0.0; May be repeated
Semesters Offered: Fall, Spring

HU 0122 - World Cultures Study Team
Students who are enrolled in World Cultures (UN1002) may sign up for a study team led by a writing center coach. Teams meet twice weekly. The meetings address the challenges of the World Cultures course as well as develop students' effectiveness working in teams. Strongly recommended for students with English/Reading ACT of 20 or below. Credits do not count toward graduation.
Credits: 0.0; May be repeated
Semesters Offered: Spring
Co-Requisite(s): UN 1002

HU 0123 - Revisions Coaching
Scheduled weekly appointment with a writing coach to improve writing and reading effectiveness in Revisions (UN2001). Strongly recommended for students with English ACT of 20 or below. Credits do not count toward graduation.
Credits: 0.0; May be repeated
Semesters Offered: Fall, Spring
Co-Requisite(s): UN 2001
HU 0124 - Graduate Student Coaching
Scheduled weekly appointment with a writing coach to improve writing and reading effectiveness in graduate courses and to address the challenges of writing theses and dissertations. Credits do not count toward graduation.
Credits: 0.0; May be repeated
Semesters Offered: Fall, Spring
Restrictions: Must be enrolled in one of the following Level(s):
Graduate

HU 0125 - Int'l GTA Assistance Program
International graduate students can enroll in HU0125 to work on cultural differences in presentation skills and to practice speaking instructional English. These students will meet weekly in group and individual settings to improve their facility as speakers of English. Credits do not count toward graduation.
Credits: 0.0; May be repeated
Semesters Offered: Fall, Spring
Restrictions: Must be enrolled in one of the following Level(s):
Graduate

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
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring

HU 2130 - Introduction to Rhetoric
Examines the classical origins, cultural contexts, and contemporary relevance of rhetorical traditions.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall

HU 2241 - 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 discussions of various aspects of the culture of the language being taught. Languages taught may include but are not limited to Ojibwe and Japanese.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall

HU 2242 - 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 Ojibwe and Japanese.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): HU 2241
HU 2271 - 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: (0-3-0)
Semesters Offered: Fall, Spring, Summer
Restrictions: May not be enrolled in one of the following Class(es): Senior

HU 2272 - Level I-B French Language and Culture
Further study of French grammar, vocabulary, idioms, continues practice of conversational skills and basic readings in French. Continues 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: (0-3-0)
Semesters Offered: Fall, Spring
Pre-Requisite(s): HU 2271

HU 2273 - 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
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand

HU 2281 - 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
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring
Restrictions: May not be enrolled in one of the following Class(es): Senior

HU 2282 - 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
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring
Pre-Requisite(s): HU 2281

HU 2291 - 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
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Senior
HU 2292 - Level I-B Spanish Language and Culture
Further study of basic 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
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): HU 2291

HU 2293 - Transitional Level I Spanish Language and Culture
Intensive review of Spanish grammar, vocabulary, and culture. Designed to prepare students with minimum essentials of oral and written Spanish for intermediate and advanced level work. Students completing this course may apply for advanced placement. Requires two years of high school Spanish or permission of instructor.

Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring

HU 2324 - 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
Lec-Rec-Lab: (0-2-3)
Semesters Offered: Fall, Spring

HU 2501 - 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. Several films may be viewed.

Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall - Offered alternate years beginning with the 2003-2004 academic year

HU 2502 - 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. Discussions may be supplemented with films

Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2003-2004 academic year

HU 2505 - 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 to the eighteenth century.

Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall - Offered alternate years beginning with the 2000-2001 academic year

Michigan Tech Undergraduate Course Descriptions Effective Fall 2006 <https://www.banweb.mtu.edu/pls/owa/stu_ctg_utils.p_online_all_courses_ug>
HU 2506 - 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
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall - Offered alternate years beginning with the 2001-2002 academic year

HU 2520 - Cultural Diversity in the Literature of the Americas
Study of literature by authors of the Americas (e.g. South, Central, and North American and the Caribbean) from historically under-represented groups. Films and essays on approaches to difference and diverse American cultures may supplement literature.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring

HU 2538 - British Experience in Literature I
A survey of major works of British literature from Beowulf to the Restoration. Focuses on the states of the developing English language. Texts may be supplemented with films.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall - Offered alternate years beginning with the 2001-2002 academic year

HU 2539 - British Experience in Literature II
A survey of major works of British authors of the nineteenth and twentieth centuries. Works may be illustrated through films and other visual media.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2002-2003 academic year

HU 2547 - World Drama
Study of the forms of dramatic literature from around the world with particular attention to thematic and dramatic development. Emphasizes performance as well as literary aspects of plays. Film versions may also be viewed.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2001-2002 academic year

HU 2548 - Adolescent Literature
Reading, reflecting on, and responding to age-appropriate adolescent literature. Works include authors from different races, cultures, historical periods, and genders. Discussion may be supplemented with films. Appropriate for students who plan to be parents, community volunteers, and teachers.
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: (0-3-0)
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
Students will explore the history, theory and applications of traditional black and white photography through readings, lecture, student presentations, and hands-on camera and darkroom work. Students will learn in-depth camera techniques and darkroom processes while also having an opportunity to explore related areas such as digital photography, color slide photography, and other photographic processes through special projects.

Credits: 3.0
Lec-Rec-Lab: (0-2-3)
Semesters Offered: Fall

HU 2640 - Professional Development and Technological Practicum A
Focuses on professional development by introducing students to educational and professional resources, educational and professional extracurricular activities, internships/co-ops, teaching experiences, and basic technologies of the field. Students develop templates for professional portfolios.

Credits: 1.0
Lec-Rec-Lab: (0-1-0)
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
Pre-Requisite(s): HU 2644

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: (0-2-3)
Semesters Offered: Spring
Pre-Requisite(s): HU 2644

HU 2700 - Introduction to Philosophy
A study of thought representing various traditions such as classical and contemporary philosophy, Eastern and Western religion, 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: Fall, Spring
HU 2702 - Ethical Theory and Moral Problems
An introduction to the major concepts and theories of normative ethics and metaethics and an examination of a variety of issues in applied ethics including poverty and economic justice, lying and truth-telling, euthanasia, sexual conduct, and issues in communication ethics.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall

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
Introduces the diversity of perspectives in speech communication with emphasis on public speaking. Topics include the nature of the public sphere, co-cultural contexts, speaking anxiety, conventional and non-Western models of structure and evidence, and speaking/listening competencies.
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: Fall

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). Computer Intensive.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): UN 1002 or UN 1003
HU 3130 - Rhetorical Theory and Criticism
A study of contemporary theories of rhetoric and their application to understanding and critiquing various forms of persuasive discourse.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): 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 to various textual media.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): (UN 1002 or UN 1003) and UN 2001

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: Spring
Pre-Requisite(s): UN 1002 or UN 1003

HU 3251 - Great Works of World Literature
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: On Demand
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): UN 1002 or UN 1003

HU 3252 - Literature in Translation
Study of non-canonical 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: On Demand
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): UN 1002 or UN 1003
HU 3253 - Topics in World Literatures and Cultures
Comparative approach to selected fictional works and essays in English translation of Western and non-Western authors.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): UN 1002 or UN 1003

HU 3261 - Communicating Across Cultures
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: On Demand
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): UN 1002 or UN 1003

HU 3262 - 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: On Demand
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): UN 1002 or UN 1003

HU 3263 - 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: On Demand
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): UN 1002 or UN 1003

HU 3264 - Topics in Spanish-Speaking Cultures
An introduction to Spanish-speaking culture (in English) in a comparative historical perspective. Includes a survey and a critical cross-cultural examination of Latin-American culture and Spanish-speaking societies (European, Caribbean, and North, Central and South American) through literature, music, film, art and other media. Spanish-speaking cultures and North American society.
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
Pre-Requisite(s): UN 1002 or UN 1003
HU 3271 - 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
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): HU 2272 or HU 2273

HU 3272 - Level II-B French Language and Culture
Reading of French texts and writing of compositions in French. Includes the use of oral French in the classroom.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): HU 3271

HU 3273 - Level II French 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
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): HU 2272 or HU 2273

HU 3274 - Topics in French Literature and Culture
A survey of French literature or of various aspects of modern French civilization and culture, emphasizing historical and cultural backgrounds. Conducted primarily in French.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Pre-Requisite(s): HU 3272 or HU 3273

HU 3275 - 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: 3.0; Repeatable to a Max of 6
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Pre-Requisite(s): HU 3272 or HU 3273

HU 3281 - 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
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): HU 2282
HU 3282 - Level II-B German Language and Culture
Reading of German texts and writing of compositions in German. Includes the use of oral German in the classroom.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): HU 3281

HU 3283 - Level II German Composition and Conversation
Extensive work on the creative use of written and oral German with emphasis on short themes in German. Conducted as much as possible in German.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): HU 2282

HU 3284 - Topics in German Literature and Culture
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
Pre-Requisite(s): HU 3282 or HU 3283

HU 3285 - German for Special Purposes
Focus on improving advanced language skills for professional communicative situations, including acquisition of discipline-specific vocabulary (preparation for language certification). Topics may include issues of science and technology in German-speaking countries.
Credits: 3.0; Repeatable to a Max of 6
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Pre-Requisite(s): HU 3282 or HU 3283

HU 3291 - Level II Spanish Language and Culture
Review of Spanish grammar and intensive vocabulary development. Reading, oral and written communication at intermediate level. Includes the use of oral Spanish in the classroom.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): HU 2292 or HU 2293

HU 3292 - Level II-B Spanish Language and Culture
Continued development of oral and written communication in the context of Hispanic culture. Reading of Spanish texts at the intermediate level including literature, film, art, and other media. Includes the use of oral Spanish in the classroom.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): HU 3291
HU 3293 - Level II Spanish for Special Purposes
Intermediate to advanced intermediate readings, discussion, and writing on selected topics as posed by intercultural communication, business, technical, scientific, or literary discourses in the context of Hispanic culture.
**Credits:** 3.0  
**Lec-Rec-Lab:** (0-3-0)  
**Semesters Offered:** Spring  
**Pre-Requisite(s):** HU 2293 or HU 3291 or HU 3292

HU 3294 - Topics in Spanish Literature and Culture
A 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 2000-2001 academic year  
**Pre-Requisite(s):** HU 3292 or HU 3293

HU 3295 - Advanced Spanish for Special Purposes
Readings, discussion and writing on literary, scientific and technological problems and discourses (specific literacies) in Hispanic language and culture, and their social, cultural and interdisciplinary interconnections both within and outside Hispanic contexts. Emphasis is placed on the understanding of key issues across disciplines and cultures.
**Credits:** 3.0; Repeatable to a Max of 6  
**Lec-Rec-Lab:** (0-3-0)  
**Semesters Offered:** Fall  
**Pre-Requisite(s):** HU 3292 or HU 3293

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 are expected to examine critically the theoretical, industrial, cultural, and aesthetic challenges posed by particular visual media and the contexts from which they emerge.
**Credits:** 3.0  
**Lec-Rec-Lab:** (0-2-3)  
**Semesters Offered:** Spring  
**Restrictions:** Permission of instructor required; May not be enrolled in one of the following Class(es):  
Freshman, Sophomore  
**Pre-Requisite(s):** 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. Films may supplement literary texts. 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 2000-2001 academic year  
**Pre-Requisite(s):** 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. Films may provide contextual background.  
Credits: 3.0  
Lec-Rec-Lab: (0-3-0)  
Semesters Offered: Spring - Offered alternate years beginning with the 2001-2002 academic year  
Pre-Requisite(s): 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. Film versions of selected novels may also be studied.  
Credits: 3.0  
Lec-Rec-Lab: (0-3-0)  
Semesters Offered: Fall - Offered alternate years beginning with the 2000-2001 academic year  
Pre-Requisite(s): 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. Film versions of selected novels may also be studied.  
Credits: 3.0  
Lec-Rec-Lab: (0-3-0)  
Semesters Offered: Fall  
Pre-Requisite(s): UN 1002 or UN 1003

HU 3512 - Shakespeare I  
Study of selected plays by Shakespeare including comedies, histories, and tragedies. Film versions of several plays may also be examined.  
Credits: 3.0  
Lec-Rec-Lab: (0-3-0)  
Semesters Offered: Fall  
Pre-Requisite(s): 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, possibly film versions of selected plays, and examination of current critical theories.  
Credits: 3.0  
Lec-Rec-Lab: (0-3-0)  
Semesters Offered: Spring  
Pre-Requisite(s): UN 1002 or UN 1003

HU 3517 - British and American Literary Studies  
A consideration of a variety of critical approaches to Literature and methods of Literary research in the context of Literary texts by British and American authors and possibly of film versions of the texts.  
Credits: 3.0  
Lec-Rec-Lab: (0-3-0)  
Semesters Offered: Spring - Offered alternate years beginning with the 2004-2005 academic year
HU 3540 - Major British Authors
Reading in depth from the works of one or more of the major British writers, excluding Shakespeare. May include examination of non-print media such as film.
Credits: 3.0; Repeatable to a Max of 6
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): UN 1002 or UN 1003

HU 3541 - Major American Authors
Reading in depth from the works of one or more major American writers. May include examination of supplementary material such as films.
Credits: 3.0; Repeatable to a Max of 6
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): UN 1002 or UN 1003

HU 3545 - Literature Across Borders
Study of literary genres, themes, and movements, with emphasis on comparing and contrasting perspectives reflected in literatures from Western and non-Western cultures. Topics may focus on historical, social, aesthetic, and cultural factors as they influence these literatures. Films may be used.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall - Offered alternate years beginning with the 2004-2005 academic year

HU 3551 - Renaissance English Literature
Study of important figures and genres in English literature from the sixteenth through the seventeenth century. Selected films may also be viewed and analyzed.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2000-2001 academic year
Pre-Requisite(s): 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. Selected films may also be viewed and analyzed.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): UN 1002 or UN 1003

HU 3553 - British Romantic and Victorian Literature
Readings of selected figures and works from nineteenth-century British literature. 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. Background material may include selected films.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): UN 1002 or UN 1003
HU 3554 - British Authors of Fiction and Fantasy
Close study of the work of one or more major British authors of the twentieth and twentieth-first centuries with attention to the writer’s style, methods, and genre usage. Will regularly focus on authors of historical fiction and fantasy. Selected films may help establish literary context.
Credits: 3.0; Repeatable to a Max of 6
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): UN 1002 or UN 1003

HU 3555 - Modern British Literature
Study of British, British colonial, and independence literature of the twentieth and twenty-first centuries. Will explore relationships between literature and other areas such as the arts, film, architecture, history, and philosophy.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2001-2002 academic year
Pre-Requisite(s): 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
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): 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: May not be enrolled in one of the following Class(es): Freshman, Sophomore

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
Pre-Requisite(s): UN 2001 and (UN 1002 or UN 1003)

HU 3629 - Special Topics in Professional Writing
Focuses on professional and workplace writing in selected genres such as reports, proposals, or grants. Teaches students to use rhetorical analysis to be more effective writers in a range of subjects. With different topics, may be repeated twice for credit.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): UN 1002 or UN 1003
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
Pre-Requisite(s): HU 2644

HU 3640 - Professional Development and Technological Practicum B
Continued professional development through exploration of job descriptions, production of internship and co-op applications, practice of interview skills, development of portfolio items, and review of professional journals and graduate school options. Students study advanced media appropriate for specific curricular strands.
Credits: 1.0
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Fall, Spring
Restrictions: Must be enrolled in one of the following Major(s): Liberal Arts, Scientific & Tech Comm (BA), Scientific & Tech Comm (BS)
Pre-Requisite(s): HU 2640

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
Pre-Requisite(s): 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
Pre-Requisite(s): 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 world view; 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
Pre-Requisite(s): UN 2002
HU 3702 - Philosophy of Religion
An examination of some philosophical questions in diverse religious traditions including the existence of God, the problem of evil, and the nature of religious experience.
**Credits:** 3.0
**Lec-Rec-Lab:** (0-3-0)
**Semesters Offered:** Fall
**Pre-Requisite(s):** UN 1002 or UN 1003

HU 3710 - Engineering Ethics
A study of ethical questions confronting individual engineers and the engineering profession. Among the issues to be explored are the meaning of professionalism, the social responsibilities of engineers, engineer-employer and engineer-client relationships, whistle-blowing, conflicts of interest, and competitive bidding.
**Credits:** 3.0
**Lec-Rec-Lab:** (0-3-0)
**Semesters Offered:** Spring
**Pre-Requisite(s):** UN 1002 or UN 1003

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 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
**Pre-Requisite(s):** UN 1002 or UN 1003

HU 3820 - Interpersonal Communication
Examines practices and issues of relational communication and encourages critical awareness of common assumptions. Topics include verbal and nonverbal cues, conflict models, friendship, intimacy, and the interpersonal significance of race, gender, class, and disability.
**Credits:** 3.0
**Lec-Rec-Lab:** (0-3-0)
**Semesters Offered:** Fall
**Pre-Requisite(s):** 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
**Pre-Requisite(s):** UN 1002 or UN 1003

HU 3850 - Cultural Studies
Examines the way that culture communicates values, feelings, beliefs; structures differential relations of power and possibility; creates difference and hierarchy. Considers the struggles over meaning that open up possibilities for diversity and change.
**Credits:** 3.0
**Lec-Rec-Lab:** (0-3-0)
**Semesters Offered:** Spring
**Pre-Requisite(s):** 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
Pre-Requisite(s): UN 1002 or UN 1003

HU 3870 - Communication Technologies and Culture
Examines the historical relationships between communication technologies (such as oral, print, electronic) and culture. Considers relationships of technology to politics, economics, space, time, power, literacy, meaning, etc.

Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): UN 1002 or UN 1003

HU 3880 - Communication and Community
Examines the relationship between communication and public and private life. Focuses on the role of public space; global, local, and virtual sites of community; and the ways diverse community life is created, sustained, repaired, and transformed through communication.

Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall - Offered alternate years beginning with the 2004-2005 academic year
Pre-Requisite(s): UN 1002 or UN 1003

HU 3890 - Documentary
Considers representations of cultural experience, focusing on written, photographic, filmic, and audio approaches to documentary in an effort to better understand the ways people struggle to grasp and explain the contradictions and instability of cultural life.

Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): UN 1002 or UN 1003

HU 3910 - Language Issues in the World
A consideration of particular issues of language use in the world today. Topics considered may include endangered languages and the future of English; how technology relates to discourse; how language is used in academia; how power is created, enacted and maintained through language; gender variation in language; etc.

Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): 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
Semesters Offered: Fall, Spring, Summer
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
Semesters Offered: Fall, Spring, Summer
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: (0-3-0)
Semesters Offered: Fall, Spring
Restrictions: Must be enrolled in one of the following Major(s): Liberal Arts; May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior

HU 4101 - 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
Pre-Requisite(s): 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 small group work and individual conferences with the goal or 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 2001-2002 academic year
Pre-Requisite(s): HU 2110 and UN 2001(C)

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, composing processes, world Englishes, computers and writing).
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2000-2001 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. Requires admission to teacher education program or permission of instructor.
Credits: 4.0
Lec-Rec-Lab: (0-3-3)
Semesters Offered: Fall
Restrictions: Permission of department required
Pre-Requisite(s): ED 3110 and ED 3210 and ED 3410 and ED 4700(C)
HU 4150 - Literacy in the Content Areas
Introduction to literacy processes 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
Pre-Requisite(s): ED 3112(C)

HU 4271 - 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 English translations.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): (HU 3274 or HU 3275) and UN 2002

HU 4272 - Modern Language 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 in French and in English translation.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall - Offered alternate years beginning with the 2001-2002 academic year
Pre-Requisite(s): HU 3274 or HU 3275

HU 4273 - Modern Language 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
Pre-Requisite(s): HU 3274 or HU 3275

HU 4281 - Modern Language Seminar I-German
Language and power. Critical study of the representation of politics, economies, 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
Pre-Requisite(s): (HU 3284 or HU 3285) and UN 2002
HU 4282 - 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 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 2001-2002 academic year
Pre-Requisite(s): HU 3284 or HU 3285

HU 4283 - Modern Language Seminar III-German
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 German and in English translation.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): HU 3284 or HU 3285

HU 4291 - Modern Language Seminar I-Spanish
Language and power. Critical study of the representation of politics, economies, and social institutions in literature, film, and authentic documents in French, German, and Hispanic language communities. Students read texts in Spanish and English translation.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): (HU 3294 or HU 3295) and UN 2002

HU 4292 - 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 speaking communities. Students read texts in Spanish and in English translation.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): HU 3294 or HU 3295

HU 4293 - Modern Language 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)
Semesters Offered: Spring
Pre-Requisite(s): HU 3294 or HU 3295

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 2001-2002 academic year
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): UN 1002 or UN 1003
**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:** May not be enrolled in one of the following Class(es): Freshman, Sophomore  
**Pre-Requisite(s):** UN 2002

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**HU 4628 - Usability and Instructions Writing**
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)  
**Semesters Offered:** Spring - Offered alternate years beginning with the 2000-2001 academic year  
**Pre-Requisite(s):** HU 3120

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**HU 4630 - Teaching with Technology Across the Curriculum**
Designed to explore use of technology-rich environments in improvement of teaching and learning and how such environments should be designed, implemented, and assessed. Includes introduction to internet, video and audio, presentational, and online assessment/portfolio technologies.

**Credits:** 3.0  
**Lec-Rec-Lab:** (0-2-2)  
**Semesters Offered:** Fall

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**HU 4634 - Advanced Practicum in Scientific and Technical Communication**
Provides technical communication majors with opportunities to design and produce various communication products expected in their working careers, such as sets of procedures, proposals, progress reports, sets of directions, and style sheets. The course will also require students to complete, with advice from the instructor, one major client-involved project such as a brochure, newsletter, web site, technical training module, etc.

**Credits:** 3.0  
**Lec-Rec-Lab:** (0-3-0)  
**Semesters Offered:** Fall, Spring  
**Restrictions:** Must be enrolled in one of the following Major(s): Scientific & Tech Comm (BA), Scientific & Tech Comm (BS)  
**Pre-Requisite(s):** HU 3120 and HU 2600

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**HU 4640 - Professional Development and Technological Practicum C**
Intense and concentrated development of professional portfolios, research into interview techniques, independent contracting, employee relationships, workplace equity, managerial positions, and graduate school opportunities. Students attend advanced communication technology workshops and prepare and teach practicum sessions for HU2644 and HU3644.

**Credits:** 1.0  
**Lec-Rec-Lab:** (0-1-0)  
**Semesters Offered:** Fall, Spring  
**Restrictions:** Must be enrolled in one of the following Major(s): Liberal Arts, Scientific & Tech Comm (BA), Scientific & Tech Comm (BS)  
**Pre-Requisite(s):** HU 2640 and HU 3640
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
Pre-Requisite(s): UN 1002 or UN 1003

HU 4690 - Special Topics in Technical Communication
In-depth examination of selected topics in scientific and technical communication.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2000-2001 academic year

HU 4700 - Topics in Philosophy
The topics will ordinarily be in-depth examinations of a particular philosopher or philosophical problem, tradition, or historical period. Examples include the philosophy of Kant, the existence of God, American pragmatism, death and dying, and ancient Greek philosophy.
Credits: 3.0; Repeatable to a Max of 9
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): UN 1002 or UN 1003

HU 4701 - Political Philosophy
Issues in political philosophy, such as the moral foundations of political systems, the proper relation between the individual and the state, and the justification of social institutions. Philosophers studied may include Plato, Aristotle, Machiavelli, Hobbes, Locke, Marx, de Tocqueville, Mill, Dewey, and Rawls.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): UN 1002 or UN 1003

HU 4890 - Topics in Communication
In-depth examination of selected issues or problems in the study of communication, such as gender and communication, the environment and communication, sound and communication, violence and communication.
Credits: 3.0; Repeatable to a Max of 9
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Pre-Requisite(s): UN 1002 or UN 1003

HU 4895 - Project in Communication
In-depth research project in communication on topic approved by faculty advisor. Topics such as gender and communication, environment and communication, sound and communication, violence and communication. Project completed under direction of faculty advisor.
Credits: 4.0
Lec-Rec-Lab: (0-4-0)
Semesters Offered: Fall, Spring, Summer
Restrictions: Must be enrolled in one of the following College(s): College of Sciences & Arts; Must be enrolled in one of the following Major(s): Comm and Culture Studies; May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior
Mathematical Sciences

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: 0.0; May be repeated
Semesters Offered: Fall, Spring
Restrictions: Permission of instructor required

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 courses and gives experience in team problem solving. Students must be enrolled in one of the following: MA1032, 1033, 1150, 1151, 1160, 1161, 2150, 2160, 3150, 3160, 3520, or 3530. Credits do not count toward graduation.
Credits: 0.0; May be repeated
Semesters Offered: Fall, Spring
Restrictions: Permission of instructor required

MA 0030 - Team Approach for College Algebra
Credits: 0.0; May be repeated
Semesters Offered: Fall, Spring, Summer
Co-Requisite(s): MA 1030

MA 0031 - Team Approach for College Algebra II
Credits: 0.0; May be repeated
Semesters Offered: Fall, Spring, Summer
Co-Requisite(s): MA 1031

MA 1020 - Quantitative Literacy
Stresses the role of contemporary mathematical thinking and the connection between mathematics and our daily lives. Topics include the mathematics of the Census, planning and scheduling, coding theory, game theory, symmetry and patterns, logic and modeling, and political flavor topics.
Credits: 4.0
Lec-Rec-Lab: (0-4-0)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Major(s): Comm and Culture Studies, Psychology, Humanities, Liberal Arts, Social Sciences, Liberal Arts with History Opt, Scientific & Tech Comm (BA), Scientific & Tech Comm (BS)

MA 1030 - College Algebra I
Part one of a two semester series for students whose algebraic preparation is not sufficient for MA1032. Topics include numerical pre-algebra skills (fractions and decimals) and basic algebra skills (exponents, polynomials, rational expressions, roots, equations and inequalities).
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring, Summer
Co-Requisite(s): MA 0030
MA 1031 - College Algebra II with Trigonometry
A continued study of algebra and trigonometry covering functions and graphs, trigonometric graphs, identities and equations, and inverse trigonometric functions. MA1030 and MA1031 together are equivalent to MA1032.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring
Co-Requisite(s): MA 0031
Pre-Requisite(s): MA 1030

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.
Credits: 4.0
Lec-Rec-Lab: (0-3-2)
Semesters Offered: Fall, Spring, Summer

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, Summer
Pre-Requisite(s): MA 1040D

MA 1135 - Calculus for Life Sciences
Topics include analytic geometry, limits, continuity of functions, transcendental functions, derivatives, integrals, and applications of the derivative in the 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
Pre-Requisite(s): MA 1032 or MA 1031
MA 1140 - Technical Calculus I
Topics include derivatives of functions, including transcendental and implicit functions, and an introduction to integration with applications in technology and business. This course is intended for non-engineering majors and will focus on applications.
Credits: 4.0
Lec-Rec-Lab: (0-4-0)
Semesters Offered: Fall, Spring, Summer
Restrictions: Must be enrolled in one of the following Major(s): Business Administration, Economics, Business, Audio Production & Technology, Theatre & Entertain Tech (BS), Sound Design, Theatre & Entertain Tech (BA), Electrical Eng Tech (BS), Mechanical Engineering Tech
Pre-Requisite(s): MA 1031 or MA 1032

MA 1150 - Differential Calculus
An introduction to single-variable calculus. Topics include functions, limits, continuity, differentiation and its uses, inverse functions, exponential and logarithmic functions, and rudiments of antidifferentiation.
Credits: 4.0
Lec-Rec-Lab: (0-4-0)
Semesters Offered: Spring
Pre-Requisite(s): MA 1032 or MA 1031

MA 1151 - Differential Calculus Plus
An introduction to single-variable calculus. Topics include functions, limits, continuity, differentiation and its uses, inverse functions, exponential and logarithmic functions, and rudiments of antidifferentiation. 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, Spring
Pre-Requisite(s): MA 1032 or MA 1031

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
Pre-Requisite(s): MA 1032 or MA 1031

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 MA1160, going at a slower pace and incorporating cooperative learning study skills.
Credits: 5.0
Lec-Rec-Lab: (0-5-0)
Semesters Offered: Fall
Pre-Requisite(s): MA 1032 or MA 1031
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 2000-2001 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 2001-2002 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 2006-2007 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 - Offered alternate years beginning with the 2003-2004 academic year

MA 2010 - Recreational Mathematics
Topics include such things as fair division, time travel, maze threading, logic puzzles and paradoxes, famous math problems and solutions, cryptarithmetic puzzles, how to use and misuse maps, mathematical humor, symmetry and coloring as problem-solving strategies, error-correcting codes, some transfinite arithmetic, and topology of compact surfaces.
Credits: 2.0
Lec-Rec-Lab: (0-2-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2001-2002 academic year
MA 2140 - Technical Calculus II
Topics include methods of integration, applications of integration in technology and business, and arithmetic and geometric sequences and series. This course is intended for non-engineering majors and will focus on applications.
Credits: 4.0
Lec-Rec-Lab: (0-4-0)
Semesters Offered: Fall, Spring, Summer
Restrictions: Must be enrolled in one of the following Major(s): Business Administration, Economics, Business, Audio Production & Technology, Theatre & Entertain Tech (BS), Sound Design, Theatre & Entertain Tech (BA), Electrical Eng Tech (BS), Mechanical Engineering Tech
Pre-Requisite(s): MA 1140 or MA 1150 or MA 1151 or MA 1160 or MA 1161 or MA 1135 or MAT 1195

MA 2150 - Integral Calculus
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
Pre-Requisite(s): MA 1150 or MA 1151 or MA 1160 or MA 1161 or MA 1135 or MA 1140

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
Pre-Requisite(s): MA 1150 or MA 1151 or MA 1160 or MA 1161 or MA 1135 or MA 1140

MA 2320 - Elementary Linear Algebra
An introduction to linear algebra and how it can be used. Topics include systems of equations, vectors, matrices, orthogonality, subspaces, and the eigenvalue problem. Not open to students with credit in MA2321 or MA2330.
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
Pre-Requisite(s): MA 1150 or MA 1151 or MA 1160 or MA 1161 or MA 1135 or MA 1140

MA 2321 - Elementary Linear Algebra
Offered first half of semester, to be taken concurrently with MA3521. The course is an introduction to linear algebra and how it can be used. Topics include systems of equations, vectors, matrices, orthogonality, subspaces and the eigenvalue problem. Not open to students with credit in MA2320 or MA2330.
Credits: 2.0
Lec-Rec-Lab: (0-4-0)
Semesters Offered: Fall, Spring
Restrictions: May not be enrolled in one of the following Major(s): Computer Science, Mathematics
Co-Requisite(s): MA 3521
Pre-Requisite(s): MA 2150 or MA 2160
MA 2330 - Introduction to Linear Algebra
An 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 MA2320 or MA2321. Course prerequisite is any math class numbered MA1090 or higher.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring
Pre-Requisite(s): MA 1140 or MA 1150 or MA 1151 or MA 1160 or MA 1161

MA 2540 - Applications of Differential Equations
Topics will include first and second order homogeneous and non-homogeneous differential equations and solution methods including LaPlace transforms. The course will focus on applications, including motion and vibration problems and AC and DC circuit problems. Intended for non-engineering majors.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Major(s): Audio Production & Technology, Theatre & Entertain Tech (BS), Sound Design, Theatre & Entertain Tech (BA), Electrical Eng Tech (BS), Mechanical Engineering Tech
Pre-Requisite(s): MA 2150 or MA 2150 or MA 2160

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 MA2720 or MA3710.
Credits: 3.0
Lec-Rec-Lab: (0-2-1)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Major(s): Mathematics
Pre-Requisite(s): MA 1140 or MA 1150 or MA 1151 or MA 1160 or MA 1161

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, Summer
Restrictions: May not be enrolled in one of the following Major(s): Mathematics
Pre-Requisite(s): MA 1020 or MA 1032 or MA 1031

MA 2910 - Mathematical Experimentation
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, proof. Projects require written reports describing the student’s findings, conjectures, and conclusions. Course prerequisite is any math course numbered MA1090 or higher.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Spring
Pre-Requisite(s): MA 1090 or MA 1160
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
Semesters Offered: Fall, Spring, Summer
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 MA2330 or MA2320 or MA2321 recommended.
Credits: 4.0
Lec-Rec-Lab: (0-4-0)
Semesters Offered: Fall, Spring
Pre-Requisite(s): MA 2150 or MA 2160 or MA 2140

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 MA2330 or MA2320 or MA2321 recommended.
Credits: 4.0
Lec-Rec-Lab: (0-4-0)
Semesters Offered: Fall, Spring, Summer
Pre-Requisite(s): MA 2150 or MA 2160 or MA 2140

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, hamming decoding.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): MA 2320 or MA 2321 or MA 2330

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, Summer
Pre-Requisite(s): MA 2320 or MA 2321 or MA 2330

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 cut-sets, combinatorial designs, Boolean algebra.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): MA 2320 or MA 2321 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, cosets, normal subgroups, homomorphisms, isomorphisms, introduction to group actions, and Burnside enumeration.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): MA 2320 or MA 2321 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
Pre-Requisite(s): MA 2150 or MA 2160

MA 3520 - Elementary Differential Equations
First order equations, linear equations, and systems of equations. Not open to students with credit in MA3521, MA3530 or MA3560.
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
Pre-Requisite(s): (MA 2150 or MA 2160) and (MA 2320 or MA 2321 or MA 2330)

MA 3521 - Elementary Differential Equations
Offered second half of semester, to be taken concurrently with MA2321. Topics include first order equations, linear equations and systems of equations. Not open to students with credit in MA3520, MA3530 or MA3560.
Credits: 2.0
Lec-Rec-Lab: (0-4-0)
Semesters Offered: Fall, Spring
Restrictions: May not be enrolled in one of the following Major(s): Computer Science, Mathematics
Co-Requisite(s): MA 2321
Pre-Requisite(s): MA 2150 or MA 2160

MA 3530 - Introduction to Differential Equations
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 MA3520, MA3521, or MA3560.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): (MA 2150 or MA 2160) and (MA 2320 or MA 2321 or MA 2330)
MA 3560 - Mathematical Modeling with Differential Equations
Creating differential equation models for physical problems such as population dynamics, kinetics, mass-spring systems. Topics include nondimensionalization, numerical methods, phase-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 MA3520, MA3521, or MA3530.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): (MA 2150 or MA 2160) and (MA 2320 or MA 2321 or MA 2330)

MA 3710 - Engineering Statistics
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 MA2720.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring, Summer
Pre-Requisite(s): MA 2150 or MA 2160

MA 3720 - Probability
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.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring
Pre-Requisite(s): MA 3150 or MA 3160

MA 3810 - Introduction to Actuarial Mathematics
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 life contingencies.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): MA 3150 or MA 3160

MA 3811 - Actuarial Exam Workshop
Participants form a study group that meets weekly. Uses SOA exams and other materials to help prepare for the SOA course and examination.
Credits: 1.0; Graded Pass/Fail Only
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Fall, Spring
Pre-Requisite(s): MA 3150 or MA 3160
MA 3910 - Techniques for Teaching Mathematics
Teaching strategies focus on the use of history, math manipulatives, problem solving, models, and technology in the secondary mathematics classroom.
Credits: 2.0
Lec-Rec-Lab: (0-1-2)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): MA 3924

MA 3924 - College Geometry with Technology
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.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): MA 2160 or MA 2330

MA 3930 - Theory of Games
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Pre-Requisite(s): MA 2320 or MA 2321 or MA 2330

MA 3990 - Math Sciences Teach Experience
Development of teaching skills through assisting in the instruction of a section of an entry-level undergraduate mathematics course. Students gain experience in leadership, group work, organization skills, cooperative exercise preparation, and class instruction.
Credits: variable to 4.0; Repeatable to a Max of 4; Graded Pass/Fail Only
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of instructor required

MA 4208 - Optimization and Graph Algorithms
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.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): MA 3210

MA 4209 - Combinatorics and Graph Theory
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.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): MA 3210
MA 4211 - Information Theory and Data Compression
An 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.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2000-2001 academic year
Pre-Requisite(s): MA 3210

MA 4308 - Theory of Numbers
Mathematical induction, Euclid’s algorithm, prime and composite integers, algebra of congruences, Chinese remainder theorem, the quadratic reciprocity law, number theoretic functions, first degree Diophantine equations, Pythagorean triples, Fermat and Mersenne numbers, factoring algorithms, tests for primality, various applications.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand - Offered alternate years beginning with the 2001-2002 academic year
Pre-Requisite(s): MA 3150 or MA 3160

MA 4310 - Abstract Algebra
Topics on groups, rings, and fields such as: group actions, the Sylow theorems, integral domains, factorization theory, Euclidean domains, principal ideal domains, splitting fields, zeros of irreducible polynomials, field extensions, and Galois theory.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2000-2001 academic year
Pre-Requisite(s): MA 3310

MA 4330 - Linear Algebra
A study of fundamental ideas in linear algebra and its applications. Includes review of basic operations, block computations; eigensystems of normal matrices; canonical forms and factorizations; singular value decompositions, pseudo inverses, least-square applications; matrix exponentials and linear systems of ODEs; quadratic forms, extremal properties, and bilinear forms.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): (MA 2320 or MA 2321 or MA 2330) and (MA 3150 or MA 3160)

MA 4410 - Complex Variables
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.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): MA 3150 or MA 3160
MA 4426 - Differential Geometry
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.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2000-2001 academic year
Pre-Requisite(s): (MA 3150 or MA 3160) and (MA 3520 or MA 3521 or MA 3530 or MA 3560)

MA 4450 - Real Analysis
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.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): MA 3450 and (MA 2320 or MA 2321 or MA 2330) and (MA 3150 or MA 3160)

MA 4490 - Applied Wavelet Analysis
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 and boundary conditions for wavelet analysis.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall - Offered alternate years beginning with the 2001-2002 academic year
Pre-Requisite(s): (MA 3150 or MA 3160) and (MA 2320 or MA 2321 or MA 2330)

MA 4515 - Introduction to Partial Differential Equations
An introduction to solution techniques for linear partial differential equations. Topics include: separation of variables, eigenvalue and boundary value problems, spectral methods, fourier series, and Green's functions. Studies applications in heat and mass transfer (diffusion eqn.), and mechanical vibrations (wave and beam eqns.).
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring, Summer
Pre-Requisite(s): (MA 3520 or MA 3521 or MA 3530 or MA 3560) and (MA 3150 or MA 3160)

MA 4520 - Integral Transforms, Special Functions, and Series Solutions to ODEs and Asymptotics
Laplace, Fourier, and other integral transforms and methods; special functions; series methods to solve ordinary differential equations.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2000-2001 academic year
Pre-Requisite(s): (MA 3520 or MA 3521 or MA 3530 or MA 3560) and (MA 3150 or MA 3160)
MA 4525 - Applied Vector and Tensor Mathematics
Introduction to vector and tensor mathematics with applications. Topics include vectors; vector differential calculus, space curves; dyadic products and matrices; gradients, divergence, curl, Laplacians; Stokes' integral theorem, Gauss theorem, conservation laws; curvilinear coordinates; tensors, material derivatives; applications of potential theory in electricity and magnetism, heat transfer, solid and fluid mechanics.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): (MA 3150 or MA 3160) and (MA 2320 or MA 2321 or MA 2330)

MA 4535 - Dynamical Systems: Control and Chaos
Ordinary differential equations and dynamical systems via a modern geometric approach, including physical and engineering applications. May include chaotic phenomena and fractals or elements of control theory.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall - Offered alternate years beginning with the 2000-2001 academic year
Pre-Requisite(s): (MA 3520 or MA 3521 or MA 3530 or MA 3560) and (MA 3150 or MA 3160)

MA 4545 - Aerodynamics
A mathematical study of the fundamental principles of 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 2001-2002 academic year
Pre-Requisite(s): (MA 3520 or MA 3521 or MA 3530 or MA 3560) and (MA 3150 or MA 3160)

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 other derivative investment instruments.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2000-2001 academic year
Pre-Requisite(s): (MA 3520 or MA 3521 or MA 3530 or MA 3560) 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 interative methods), eigenvalue problems, least squares, singular value decomposition. Includes a review of elementary linear algebra and the use of appropriate software.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): MA 2320 or MA 2321 or MA 2330
MA 4620 - Finite Difference Methods for PDEs
Derivation, analysis, and implementation of finite difference methods; applications to fluid mechanics, elasticity, heat conduction, acoustics, or electromagnetism. Difference equations, Taylor series, stability, and convergence. Finite difference methods for partial differential equations; alternate methods (spectral, finite element, or particle) for discretizing space.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): (MA 3520 or MA 3521 or MA 3530 or MA 3560) and (MA 3150 or MA 3160)

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 space concepts, finite element methodology, convergence, errors, and element selection.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): (MA 3520 or MA 3521 or MA 3530 or MA 3560) and (MA 3150 or MA 3160)

MA 4630 - Numerical Methods
Solution of nonlinear equations in one variable, interpolation, polynomial approximation, numerical integration/differentiation, and numerical solution of initial-value problems.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): MA 3530

MA 4635 - Numerical Methods for Integral Equations
Includes quadrature and quadrature methods for solving integral equations that occur in many scientific disciplines (imaging, aerodynamics, etc.).
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall - Offered alternate years beginning with the 2000-2001 academic year
Pre-Requisite(s): (MA 3520 or MA 3521 or MA 3530 or MA 3560) 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
Pre-Requisite(s): MA 2720 or MA 3710

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
Pre-Requisite(s): MA 2710 or MA 2720 or MA 3710
MA 4730 - Nonparametric Statistics
Survey of distribution free statistical inference procedures. Topics include a review of probability and distribution theory, one sample, paired samples, multi-sample location tests, tests of independence and related measures of association, goodness-of-fit tests and tests based on the cumulative distribution function.

Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): MA 2710 or MA 2720 or MA 3710

MA 4740 - Sampling Methods
Topics include survey construction, sources of error in surveys, estimation of population parameters from simple random, stratified, systematic, and multi-stage samples, effects of and remedies for non-response, hypothesis testing survey data, and other topics as time permits. Students cannot receive credit for both MA4740 and MA5740.

Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand

MA 4750 - Applied Multivariate Statistics
An introduction to analysis of multidimensional data with emphasis on applications. Topics include inference for multivariate normal distribution, classification, cluster analysis, dimension reduction.

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, Sophomore, Junior

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
Pre-Requisite(s): 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
Pre-Requisite(s): 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 - Offered alternate years beginning with the 2004-2005 academic year
Pre-Requisite(s): 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: Spring - Offered alternate years beginning with the 2005-2006 academic year  
Pre-Requisite(s): 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  
Semesters Offered: Fall, Spring, Summer  
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  
Pre-Requisite(s): MA 3210 or MA 3310 or MA 3924

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. Completion of MA3150 or MA3160 is recommended.

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, Sophomore  
Pre-Requisite(s): UN 2002

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  
Semesters Offered: Fall, Spring, Summer  
Restrictions: Permission of instructor required
MEEM 1500D - Mechanical Engineering Problem Solving
Introduces students to the use of a higher level programming language. Examples of the application of the language to the solution of problems in mechanical engineering are emphasized. Applications include indexing loops, arrays, logical operations, control flow, and output manipulation including two and three dimensional graphics.
Credits: 1.0
Lec-Rec-Lab: (0-1-0)
Semesters Offered: On Demand

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: (0-3-0)
Semesters Offered: Fall, Spring, Summer
Restrictions: Must be enrolled in one of the following College(s): College of Engineering, Sch of Forest Res & Envir Sci
Pre-Requisite(s): MA 2160 or MA 2150

MEEM 2111D - 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.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring, Summer
Pre-Requisite(s): MA 2160 or MA 2150

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 loading of circular cross sections, and flexural loading of straight members. Also covers stresses due to combined loading and buckling of columns.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring, Summer
Pre-Requisite(s): MEEM 2110

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 loading of circular cross-sections, and flexural loading of straight members. Also covers stresses due to combined loading and buckling of columns.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Pre-Requisite(s): MEEM 2111D
MEEM 2200 - Thermodynamics
Introduces fundamental concepts of heat and power. Presents property relationships incompressible substances, simple pure substances, and ideal gases. Applies the first and second laws of thermodynamics to the analyses of processes for open and closed systems. Also covers thermodynamic cycles.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring, Summer
Restrictions: Must be enrolled in one of the following College(s): College of Engineering
Pre-Requisite(s): (MA 2160 or MA 2150) and (CH 1100 or CH 1110)

MEEM 2500 - Integrated Design and 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. Incorporates computer-aided manufacturing tools.
Credits: 4.0
Lec-Rec-Lab: (0-3-3)
Semesters Offered: Fall, Spring
Restrictions: Must be enrolled in one of the following Major(s): Engineering, Engineering-Mechanical Design, Engineering-Manufacturing, Mechanical Engineering, Biomedical Engineering
Pre-Requisite(s): ENG 1102 and MY 2100(C)

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, Summer
Pre-Requisite(s): PH 2100 and (MEEM 2110 or ENG 2120) and (MA 3160(C) or MA 3150(C))

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
Restrictions: Must be enrolled in one of the following Major(s): Mechanical Engineering
Pre-Requisite(s): (MEEM 2150(C) or ENG 2120) and MEEM 3230(C) and MEEM 3700(C) and EE 3010

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, Summer
Co-Requisite(s): MEEM 3220
Pre-Requisite(s): MEEM 2200 and MEEM 2700(C)
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: (0-0-2)
Semesters Offered: Fall, Spring, Summer
Restrictions: Must be enrolled in one of the following Major(s): Mechanical Engineering
Co-Requisite(s): MEEM 3210
Pre-Requisite(s): MEEM 2200

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, Summer
Pre-Requisite(s): MEEM 3210 and (MA 3520 or MA 3521 or MA 3530 or MA 3560)

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, Summer
Pre-Requisite(s): MEEM 2700 and MEEM 2150 and MEEM 2500 and (MA 2320(C) or MA 2321(C) or MA 2330(C))

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, Summer
Pre-Requisite(s): MEEM 3501 and (MA 3520(C) or MA 3521(C) or MA 3530(C))

MEEM 3700 - Mechanical Vibrations
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring, Summer
Pre-Requisite(s): MEEM 2700 and (MA 3520 or MA 3521 or MA 3530 or MA 3560) and (MA 2320 or MA 2321 or MA 2330)
**MEEM 3999 - Mechanical Engineering Undergraduate Research Project**
An undergraduate research experience during the junior year in mechanical engineering. Students work directly with faculty on active research projects/grants. A report will be submitted and graded.
**Credits:** 3.0; Repeatable to a Max of 6
**Lec-Rec-Lab:** (0-3-0)
**Semesters Offered:** Fall, Spring, Summer
**Restrictions:** Permission of instructor required; Must be enrolled in one of the following Major(s): Mechanical Engineering, Mechanical Eng-Eng Mechanics; May not be enrolled in one of the following Class(es): Freshman, Sophomore, Senior

**MEEM 4150 - Intermediate Mechanics of Materials**
**Credits:** 3.0
**Lec-Rec-Lab:** (0-3-0)
**Semesters Offered:** Fall
**Pre-Requisite(s):** MEEM 2150

**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
**Pre-Requisite(s):** MEEM 2150

**MEEM 4170 - Failure of Material in Mechanics**
Identifies the modes of mechanical failure that are essential to prediction and prevention of mechanical failure. Discusses theories of failure in detail. Treats the topic of fatigue failure extensively and brittle fracture, impact and buckling failures at some length.
**Credits:** 3.0
**Lec-Rec-Lab:** (0-3-0)
**Semesters Offered:** Spring
**Pre-Requisite(s):** MEEM 3501

**MEEM 4180 - Engineering Biomechanics**
Engineering mechanics applied to the human body in health and disease or injury, which includes mechanics of human biological materials and engineering design in musculo-skeletal system. Also studies on 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
**Pre-Requisite(s):** MEEM 2150 and MEEM 2700
MEEM 4200 - Principles of Energy Conversion
Introduces basic background, terminology, and fundamentals of energy conversion. Discusses current and emerging technologies for production of thermal, mechanical, and electrical energy. Topics include fossil and nuclear fuels, solar energy, wind turbines, fuel and solar cells.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2005-2006 academic year
Pre-Requisite(s): MEEM 3230(C)

MEEM 4210 - Computational Methods in Thermal Sciences
Introduces computational methods used to solve thermodynamic, fluid mechanic, and heat transfer problems. Discusses theoretical and practical aspects. Modern computer-based 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
Pre-Requisite(s): MEEM 3230(C)

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
Pre-Requisite(s): MEEM 3210

MEEM 4240 - Combustion & Air Pollution
Introduces physico-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
Restrictions: Must be enrolled in one of the following College(s): College of Engineering; May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior
Pre-Requisite(s): MEEM 2200

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 - Offered alternate years beginning with the 2004-2005 academic year
Pre-Requisite(s): MEEM 3230(C)
MEEM 4403 - Computer-Aided Design Methods
Students apply fundamental and advanced solid modeling techniques to construct solid models of mechanical systems, simulate the motion of the system, and document the design. Students use shared data to function in a concurrent design environment and identify major functional features of commercial CAD software.
Credits: 4.0
Lec-Rec-Lab: (3-0-2)
Semesters Offered: Fall, Spring, Summer
Restrictions: Must be enrolled in one of the following Major(s): Mechanical Engineering, Engineering-Manufacturing, Mechanical Eng-Eng Mechanics; May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): ENG 1102

MEEM 4403D - Computer-Aided Design Methods (Distance Program)
Students apply fundamental and advanced solid modeling techniques to construct solid models of mechanical systems, simulate the motion of the system, and document the system’s design. Students use shared data to function in a concurrent design environment and identify major functional features of commercial CAD software.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring, Summer
Restrictions: Must be enrolled in one of the following College(s): College of Engineering
Pre-Requisite(s): 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: (0-3-2)
Semesters Offered: Spring
Pre-Requisite(s): 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: (0-3-0)
Semesters Offered: Fall, Spring, Summer
Pre-Requisite(s): MEEM 3502(C)

MEEM 4405 - Intro to the 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, Summer
Pre-Requisite(s): MEEM 3502 and (MA 2320 or MA 2321 or MA 2330) and (MA 3520 or MA 3521 or MA 3530 or MA 3560)
MEEM 4610 - Advanced Machining Processes
Covers mechanics of 2-D and 3-D cutting and their extension to commonly used conventional processes such as turning, boring, milling, and drilling. Topics include force modeling, surface generation, heat transfer, tool life and dynamics.

Credits: 4.0
Lec-Rec-Lab: (0-3-2)
Semesters Offered: Spring
Pre-Requisite(s): MEEM 2500

MEEM 4610D - Advanced Machining Processes
Covers mechanics of 2-D and 3-D cutting and their extension to commonly used conventional processes such as turning, boring, milling, and drilling. Topics include force modeling, surface generation, heat transfer, tool life and dynamics. Credit may not be received for more than one of the following: MEEM 4610, 4610D and 5610.

Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Restrictions: Must be enrolled in one of the following Campus(s): Extended University Programs
Pre-Requisite(s): MEEM 2500

MEEM 4615 - 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
Pre-Requisite(s): 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: On Demand
Pre-Requisite(s): MEEM 2500 and MEEM 2150

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: Fall
Pre-Requisite(s): MEEM 3700(C) and MEEM 3502(C)
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, Spring
Pre-Requisite(s): MY 2100 and MEEM 2150 and MEEM 3210 and MEEM 3230(C)

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, Spring
Pre-Requisite(s): MEEM 3502(C)

MEEM 4650 - Quality Engineering
Introduction to the concepts and methods of quality and productivity 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 MEEM4650 and MEEM5650.
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, Sophomore
Pre-Requisite(s): 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
Pre-Requisite(s): 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: May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior
MEEM 4685 - Env Resp Design & Manuf
Examines the impact of engineering and design/manufacturing, decisions 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 prevention.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2001-2002 academic year
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior

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
Pre-Requisite(s): 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: On Demand
Restrictions: Permission of department required
Pre-Requisite(s): MEEM 3700

MEEM 4701 - Analy 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
Pre-Requisite(s): and MEEM 3000 MEEM 3700

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
Pre-Requisite(s): (MA 3160 or MA 3150) and MEEM 2700
MEEM 4705 - Introduction to Robotics and Mechatronics
Cross-discipline system integration of sensors, actuators, and microprocessors to achieve high-level design requirements, including robotic systems. A variety of sensor and actuation types are introduced, from both a practical and a mathematical perspective. Embedded microprocessor applications are developed using the C programming language.
Credits: 4.0
Lec-Rec-Lab: (0-3-3)
Semesters Offered: Fall
Pre-Requisite(s): MEEM 4700(C)

MEEM 4900 - Senior Design I
Students work in teams on "open-ended" engineering design projects - most with industrial sponsors - developing original and creative solutions to real engineering problems. Lectures include the design process, design tools, project management, engineering communication (oral/written), engineering ethics, and intellectual property.
Credits: 3.0
Lec-Rec-Lab: (2-0-3)
Semesters Offered: Fall, Spring
Pre-Requisite(s): MEEM 3501

MEEM 4900D - Senior Design I
Introduces computer-aided design (CAD) and finite element methods as tools for engineering design. Senior projects are selected/assigned with initial concepts evaluated using CAD methods. Covers project management methods and emphasized communications, oral and written
Credits: 3.0
Lec-Rec-Lab: (2-0-3)
Semesters Offered: On Demand
Restrictions: Must be enrolled in one of the following Campus(s): Extended University Programs
Pre-Requisite(s): MEEM 4405 and MEEM 4992D and MEEM 4993D

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. (Senior project ready as defined by major substitutes for prerequisites)
Credits: 3.0
Lec-Rec-Lab: (1-0-6)
Semesters Offered: Fall, Spring
Pre-Requisite(s): MEEM 4900 and MEEM 3000

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
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of department required; May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): MET 3250
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 freeform 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
Pre-Requisite(s): (MEEM 4991D or ENGR 1102) and (MA 1160 or MA 1040D)

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
Pre-Requisite(s): MEEM 2500 and MEEM 4992D and MY 2100

MEEM 4994D - Powertrain Packaging
Explores the designer's role in powertrain packaging issues and practices such as overview of major dynamic phenomenon that characterizes powertrain behavior. Emphasis on interaction between subsystems.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Pre-Requisite(s): (MEEM 4991D or MEEM 4403D) and (MEEM 2151D or MEEM 2150)

MEEM 4999 - Mechanical Engineering Senior Research Thesis
An undergraduate research experience during the senior year in mechanical engineering. Students begin work on an active research project/grant with faculty or continue work from the previous year. A thesis will be published in the department and archived.
Credits: 3.0; Repeatable to a Max of 6
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of instructor required; Must be enrolled in one of the following Major(s): Mechanical Engineering, Mechanical Eng-Eng Mechanics; May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior
Mechanical Engineering Technology

**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

**MET 2000 - Power Transmission**
Introduction to mechanical devices: simple machines, gears, belts, chains, clutches, couplings and linkages. Hydraulics, pneumatics and heat engines theory along with some industrial control are introduced. Classroom and hands-on lab experiences in the synthesis of power transmission components are provided.

**Credits:** 3.0  
**Lec-Rec-Lab:** (0-2-2)  
**Semesters Offered:** Spring  
**Pre-Requisite(s):** MAT 1155 or MA 1032 or MA 1031

**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  
**Pre-Requisite(s):** MA 1135(C) or MA 1140(C) or MA 1150(C) or MA 1151(C) or MA 1160(C) or MA 1161(C) or MAT 1195

**MET 2130 - Dynamics**
An introduction to particle and rigid plane body kinematics and kinetics for technology students. Inertia force, work-energy-power and impulse-momentum methods are applied. Emphasizes development of student skills in problem definition and problem solving.

**Credits:** 3.0  
**Lec-Rec-Lab:** (0-3-0)  
**Semesters Offered:** Fall, Spring  
**Pre-Requisite(s):** MET 2120

**MET 2400 - Practical Applications in Parametric Modeling**
Intermediate course intended to expand the student’s knowledge of computer modeling techniques, introducing advanced assemblies and GD&T concepts. Investigates advanced concepts available to the designer.

**Credits:** 3.0  
**Lec-Rec-Lab:** (0-2-2)  
**Semesters Offered:** Fall, Spring  
**Pre-Requisite(s):** ENG 1102
MET 3242 - Machine Design I
Kinematic analysis and design of basic mechanisms. Belt, chain and gear drive design and analysis. Cam design and analysis. Static and dynamic force analysis.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): (MAT 2215 or MA 2140 or MA 2160) and MET 2130

MET 3250 - Applied Fluid Mechanics
Introduction to the basic principles of fluid statics and dynamics for technology students. Emphasizes applications in fluid transfer and fluid power, including selection of components for efficient system operation. A laboratory exposes students to current design and testing practices.
Credits: 4.0
Lec-Rec-Lab: (0-3-2)
Semesters Offered: Fall
Pre-Requisite(s): MET 2130

MET 3450 - Machine Design II
A 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: Spring
Pre-Requisite(s): MET 3242

MET 3600 - Applied Thermodynamics
Introduction to engineering thermodynamic principles for technology students. Topics include work, heat and temperature, pure substances, closed and open systems, first and second laws of thermodynamics, power and refrigeration cycles.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): MET 3250

MET 4200 - Design of Experiments
This course provides basic knowledge required to develop statistical experiments to improve quality of process and products. The student will begin designing simple experiments and expand to apply advance principles to study interaction between variables. A strong foundation will be provided allowing the student to progress to Taguchi experimental design techniques.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): MA 2720
**MET 4300 - Applied Heat Transfer**
Introduction to heat transfer principles for technology students. Topics include conduction, convection and radiation heat transfer mechanisms. Practical applications include thermal insulation, heat sink and heat exchanger design.

**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  
**Pre-Requisite(s):** MET 3600

**MET 4377 - Applied Fluid Power**
Covers hydraulic and pneumatic components and systems used in industrial and mobile applications. Includes component selection, open and closed loop circuit operation and design, electrical controls, system maintenance, noise and heat generation. Design projects are included.

**Credits:** 3.0  
**Lec-Rec-Lab:** (0-2-2)  
**Semesters Offered:** Spring - Offered alternate years beginning with the 2007-2008 academic year  
**Pre-Requisite(s):** MET 3250

**MET 4390 - Internal Combustion Engines**
An introduction to the basic principles and applications of internal combustion engines for technology students. Emphasizes design, development and testing of engine components and systems. A laboratory exposes students to current industry practices.

**Credits:** 3.0  
**Lec-Rec-Lab:** (0-2-2)  
**Semesters Offered:** Spring - Offered alternate years beginning with the 2006-2007 academic year  
**Pre-Requisite(s):** MET 3600(C) or MET 3361

**MET 4400 - Manufacturing Simulation**
Introductory course in computer simulation designed to model processes found in the manufacturing or service environment. Computer software will be used to model real life problems, analyze alternative solutions and generate recommendations. Projects involving local manufacturing and service situations will be modeled.

**Credits:** 3.0  
**Lec-Rec-Lab:** (0-2-2)  
**Semesters Offered:** Spring - Offered alternate years beginning with the 2006-2007 academic year  
**Pre-Requisite(s):** MA 2720 or MA 2710 or MA 3710

**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  
**Pre-Requisite(s):** MET 3450
MET 4500 - Lean Manufacturing, Principles, Concepts and Applications
Provides an understanding of current concepts required to implement lean manufacturing in various manufacturing and service sectors. Focus is on the essentials required to provide products and services that meet customer demand with reduced lead times, elimination of waste and safety improvements.
**Credits:** 3.0
**Lec-Rec-Lab:** (2-0-2)
**Semesters Offered:** Spring - Offered alternate years beginning with the 2007-2008 academic year
**Restrictions:** Must be enrolled in one of the following Class(es): Junior, Senior

MET 4550 - Computer Aided Manufacturing
Course is designed to apply techniques used in parametric modeling (CAD) and convert this information to all phases of production planning, machining, scheduling and quality control.
**Credits:** 3.0
**Lec-Rec-Lab:** (0-2-2)
**Semesters Offered:** On Demand
**Restrictions:** Must be enrolled in one of the following Class(es): Junior, Senior
**Pre-Requisite(s):** MEEM 2500 and MET 2400

MET 4580 - Facilities Planning, Layout and Process Flow
Course works through the basics of site selection, plant layout, disaster control, energy conservation, and pollution abatement. Attention will be given to equipment selection, strategy and material flow.
**Credits:** 3.0
**Lec-Rec-Lab:** (0-2-1)
**Semesters Offered:** On Demand
**Restrictions:** Must be enrolled in one of the following Class(es): Senior

MET 4590 - Production Planning and Control
Course includes essential activities associated with both service sector and manufacturing activities required to forecast, schedule and determine functional requirements to produce a product or service.
**Credits:** 3.0
**Lec-Rec-Lab:** (0-3-0)
**Semesters Offered:** On Demand
**Restrictions:** Must be enrolled in one of the following Class(es): Senior

MET 4600 - Computer Aided Methods in Thermal Science
Course makes extensive use of modern computer based tools to solve problems in fluid mechanics, heat transfer and thermodynamics.
**Credits:** 3.0
**Lec-Rec-Lab:** (0-3-0)
**Semesters Offered:** On Demand
**Restrictions:** Must be enrolled in one of the following Class(es): Junior, Senior
**Pre-Requisite(s):** (MET 3600 and MET 4300) or MET 3361

MET 4660 - Applied Finite Element Analysis
Comprehensive use of both computer derived solutions and experimental validation of analytical and finite element solutions using methods such as strain gages, photoelasticity and brittle coatings.
**Credits:** 3.0
**Lec-Rec-Lab:** (0-2-2)
**Semesters Offered:** On Demand
**Restrictions:** Must be enrolled in one of the following Class(es): Junior, Senior
**Pre-Requisite(s):** MET 3450 and MET 2400
MET 4670 - Senior Project
Completion and evaluation of design projects using computer-aided engineering methods, physical models, and/or prototypes. Evaluation and design optimization methods for efficient and cost-effective designs. Oral/written report and comprehensive exam.

Credits: 3.0
Lec-Rec-Lab: (0-0-6)
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of instructor required
Pre-Requisite(s): MET 4460

MET 4780 - Advanced Manufacturing
An introduction to advanced manufacturing processes, both traditional and nontraditional. Study of both theory and practice will be tied to laboratory experiments utilizing a spectrum of unique materials and methods.

Credits: 3.0
Lec-Rec-Lab: (0-2-3)
Semesters Offered: Spring - Offered alternate years beginning with the 2007-2008 academic year
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): MET 4460

MET 4900 - Alternative Energy Systems
Presents an overview of world energy resources and energy consumption trends. Conventional and emerging energy sources and conversion methods are discussed in terms of their long term viability, based on technical and political factors.

Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2006-2007 academic year
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): MET 3600 or MET 3361

MET 4999 - Senior Project Seminar
Course designed to review and evaluate the program objectives linked with industrial partners and accreditation body. Focus given to preparing the student to take the PE (Professional Engineer) and/or the CMfgT (Certified Manufacturing Technologist) exams.

Credits: 1.0
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Fall, Spring
Restrictions: Must be enrolled in one of the following Class(es): Senior
Materials Science & Engrg

MY 2000 - Introduction to Materials Processing
Introduction to the science and technology of the production of primary and engineering materials. Topics include mineral processing, extractive metallurgy, casting, deformation processing, powder fabrication, thin film deposition, joining and machining. Demonstrations and laboratory exercises will be employed to highlight these processing techniques.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Spring
Pre-Requisite(s): ENG 1101 or ENG 1100

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.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring, Summer
Pre-Requisite(s): CH 1100 or CH 1110

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.
Credits: 4.0
Lec-Rec-Lab: (4-0-0)
Semesters Offered: Fall
Pre-Requisite(s): MY 2100

MY 3110 - Materials Processing II
A 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.
Credits: 4.0
Lec-Rec-Lab: (4-0-0)
Semesters Offered: Spring
Pre-Requisite(s): MY 3100

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
Pre-Requisite(s): 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 particulate analysis, scanning tunneling and atomic force microscopy. Discusses the limitations/capabilities of basic characterization techniques as well as data analysis methods and practices.

**Credits:** 4.0  
**Lec-Rec-Lab:** (2-1-3)  
**Semesters Offered:** Spring  
**Pre-Requisite(s):** 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 (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  
**Pre-Requisite(s):** MY 3100 and MY 3200

**MY 3400 - Mechanical Properties of Materials**
An 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  
**Pre-Requisite(s):** MY 2100 and (MEEM 2150 or ENG 2120)

**MY 3700 - Electronic, Optical, and Magnetic Properties of Materials**
Provides background needed to understand how electrons and electromagnetic waves interact with materials. Topics include waves, bonding, phonons, bands, the basics of semiconducting, metallic, dielectric, optical, and magnetic material properties, and how elementary devices made from these materials operate.

**Credits:** 4.0  
**Lec-Rec-Lab:** (3-1-0)  
**Semesters Offered:** Fall  
**Pre-Requisite(s):** (PH 2200 or PH 2260) and (MA 3150 or MA 3160) and (MA 3520 or MA 3530) or (MA 2321 and MA 3521)

**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:** (2-0-3)  
**Semesters Offered:** Fall  
**Restrictions:** May not be enrolled in one of the following Class(es): Freshman, Sophomore  
**Pre-Requisite(s):** MY 2100
MY 4140 - Science of Ceramic Materials
The structure, defect chemistry, and properties of crystalline and amorphous ceramics. Utilization of these materials in a variety of applications such as electrolytes in fuel cells and as bioceramics are examined.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Pre-Requisite(s): MY 2100

MY 4150 - Composite Materials
Structure, processing and properties of composite materials based on combinations of metals, ceramics, and polymers.
Credits: 2.0
Lec-Rec-Lab: (2-0-0)
Semesters Offered: Spring
Pre-Requisite(s): 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 4180 - Science and Engineering of Structural Metals
Examines what exactly makes a particular industrial alloy useful. From the light metals (aluminum, magnesium and titanium) to the heavy weights (nickel and high alloy steels), this course examines the structure, properties, and processing of metals into industrially useful materials. Covers internationally accepted alloy designations, heat treatment standards, modification and processing.
Credits: 3.0
Lec-Rec-Lab: (2-1-0)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior
Pre-Requisite(s): MY 2100 and MY 3300

MY 4190 - Environmental Engineering for Materials Processing Industries
Assessment and analysis of environmental impacts from materials processing industries. Regulations, permits, and industrial practices for monitoring and solving air, water, and solid environmental issues. Pollution prevention. Life cycle analysis. Material flow analysis.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore

MY 4200 - Introduction to Scanning Electron Microscopy
Practical training on the operation and image formation in a scanning electron microscope (SEM). Applications of the SEM to the analysis of metallic, ceramic, geological and biological materials are discussed, including qualitative chemical analysis using energy dispersive spectroscopy. Offered second half of fall semester.
Credits: 2.0
Lec-Rec-Lab: (1-0-3)
Semesters Offered: Fall
MY 4240 - Introduction to MEMS
Fundamentals of micromachining and microfabrication techniques, including planar thin-film process
technologies, photolithographic techniques, deposition and etching techniques, and the other
technologies that are central to MEMS fabrication.
Credits: 4.0
Lec-Rec-Lab: (3-1-0)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior

MY 4240D - Introduction to MEMS
Fundamentals of micromachining and microfabrication techniques, including planar thin-film process
technologies, photolithographic techniques, deposition and etching techniques, and the other
technologies that are central to MEMS fabrication.
Credits: 4.0
Lec-Rec-Lab: (3-1-0)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior

MY 4410 - Metal Forming
Introduction to metal forming, including rolling, forging, extrusion, drawing, stamping, and sheet metal
forming. Covers practical aspects of manufacturing processes, as well as continuum-mechanical and
finite element modeling of deformation during working, and metallurgical aspects of forming
processes and resulting products.
Credits: 2.0
Lec-Rec-Lab: (2-0-0)
Semesters Offered: Spring
Pre-Requisite(s): MY 3400 or MEEM 2150

MY 4600 - Introduction to Polymer Engineering
Basics in polymer science including molecular characteristics, synthesis, structure and properties of
polymers. Various processing techniques and mechanical/ structural applications of polymers.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Pre-Requisite(s): MY 2100

MY 4710 - Photonic and Micromechanical Materials and 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 4740 - Hydrometallurgy/Pyrometallurgy
Extracting metal from ores by aqueous chemical techniques. The unit processes and unit operations
in the dissolution, solubility, aqueous chemistry, concentrating and purifying metal-bearing solutions,
and recovery of metals by precipitation and electrolytic processing will be discussed.
Credits: 4.0
Lec-Rec-Lab: (4-0-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2004-2005 academic year
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): CH 1120
MY 4800 - Material and 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: (3-0-0)
Semesters Offered: Spring
Pre-Requisite(s): MY 2100

MY 4900 - Materials Science and Engineering Professional Development
Engineering ethics, professional registration, industrial safety and hygiene, intellectual property, professional development and communication skills in the context of Capstone Senior Design and professional employment.
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, Sophomore, Junior
Pre-Requisite(s): MY 3110 and MY 3210 and MY 3300 and MY 3400

MY 4901 - Materials Science and Engineering Senior Design Project I
Conducted in teams of students working with an industrial partner. Open to all engineering majors interested in interdisciplinary senior design projects. Non-MSE majors must be senior project ready as defined by their major program and obtain permission of the MSE department.
Credits: 2.0
Lec-Rec-Lab: (0-0-6)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior
Co-Requisite(s): MY 4900
Pre-Requisite(s): MY 2100 and MY 3110 and MY 3210 and MY 3300 and MY 3400

MY 4910 - Materials Science and Engineering Senior 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. (Senior project ready as defined by major substitutes for prerequisites)
Credits: 3.0
Lec-Rec-Lab: (0-1-6)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior
Pre-Requisite(s): MY 4901

MY 4970 - Special Topics - Materials
Special topics in materials science and engineering.
Credits: variable to 4.0; May be repeated
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of instructor required

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
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of instructor required
Physical Education

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 0102 - Orienteering
"Hands on" course teaches basic principles of orienteering including map reading emphasizing terrain association/elevation, map margin information, topographic symbology, and determining location using intersection and resection techniques. Offered first half and last 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, lures, and line as well as a valid current year 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 is physically strenuous. Personal frisbee is recommended. Offered the first half of fall semester.

Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Summer

PE 0105 - Beginning Bowling
Fundamental skills, rules, and scoring of bowling. Offered the first and 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 0106 - Beginning Golf
Rules, terminology, and etiquette of golf and the individual skills of grip, stance, and swing. Equipment is supplied. Offered the first half of fall semester, the second half of spring semester, and the first half of summer.

Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring, 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 and second half of spring semester.

Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring
PE 0108 - Broomball
Students will learn the rules, strategy, and safety needed to compete in broomball. Offensive and defensive zone coverages and individual skills are stressed. Team play with 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 0115 - 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 one track of summer.
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 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 a helmet with a facemask. Offered the first and second 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 of alpine skiing techniques. Basic skills taught, evaluated, and recommendations made for improvement. Own equipment recommended. Daily rental and "rent for the season" equipment available. Season pass required 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 0121 - Beginning Snowboarding
Beginning skills of snowboarding techniques. Basic skills taught, evaluated, and recommendations made for improvement. Own equipment recommended. Daily rental and "rent for the season" equipment available. Season pass required 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 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 and tracks A and B of summer session.

Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Summer

PE 0125 - Sand Volleyball
Sand volleyball history, philosophy, and rules. Passing, setting, attacking, serving, blocking, round robin, 2 vs. 2, and 4 vs. 4 tournaments, 6 vs. 6 system and drills to improve one’s overall play. Offered first half of fall semester and summer.

Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, 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 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 0135 - Beginning Cross Country Skiing
Develop 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 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 0139 - Beginning Badminton
Fundamental skills, rules, and scoring of badminton. 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 0140 - Beginning Tennis
Fundamentals of the game, rules, and etiquette of tennis. Meets at Gates Tennis Center. Tennis balls and racquets provided. Recommend use of personal racquet. Offered the first half and the last half of fall and spring semesters, 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 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 and last half of fall semester, and the first and last 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 0150 - Leisure Sports
This class will introduce students to a variety of recreational activities often used in a social/leisure setting (ie - shuffleboard). Offered the first and second half of fall and spring semesters as well as summer tracks A and B.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring, Summer
PE 0152 - Beginning Social Dance
Introduction to a variety of dance steps, such as the jitterbug/swing, polka, country 2 step, tango, waltz, foxtrot, and slow dance. 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 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 0155 - Beginning Road Biking
Learn to be comfortable and confident while riding a regular road bike. Covers basic maintenance repair procedures. Requires own equipment and supplies, including a bike helmet. Offered first half of fall semester.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall

PE 0156 - Beginning Mountain Biking
Learn to be comfortable and confident while riding a mountain bike off-road. Covers basic maintenance repair 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, Summer

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

PE 0170 - Beginning Tae Kwon Do 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, Summer
**PE 0174 - Winter Outdoor Adventures**
Outdoor seasonal activities to include fishing, camping, skiing, orienteering, etc. Offered the first half of spring semester.

*Credits*: 0.5; Graded Pass/Fail Only  
*Lec-Rec-Lab*: (0-0-2)  
*Semesters Offered*: Spring

**PE 0175 - Hiking**
Fundamental knowledge and skills specific to hiking will be covered. Good hiking boots, backpack, and compass are required. Course may meet on some weekends. Offered tracks A and B of summer session.

*Credits*: 0.5; Graded Pass/Fail Only  
*Lec-Rec-Lab*: (0-0-2)  
*Semesters Offered*: Summer

**PE 0205 - Intermediate Bowling**
Intermediate to advanced techniques in bowling, including skills and strategy involved in tournament play. Offered the first and 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 0206 - Intermediate 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 both tracks of summer session.

*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 changing student interests. Topics vary. Offered the first half and the last half of fall and spring semesters, and the first and second tracks of summer session. May count once for co-curricular general education credit.

*Credits*: 0.5; Repeatable to a Max of 1; Graded Pass/Fail Only  
*Lec-Rec-Lab*: (0-0-2)  
*Semesters Offered*: Fall, Spring, Summer

**PE 0215 - 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 one track of summer.

*Credits*: 0.5; Graded Pass/Fail Only  
*Lec-Rec-Lab*: (0-0-2)  
*Semesters Offered*: Fall, Spring, Summer

**PE 0216 - Intermediate 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 Hockey
Intermediate/advanced techniques, skills, and strategies in hockey. Requires basic equipment to be allowed on the ice as well as a helmet with a 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 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 Pass/Fail Only
**Lec-Rec-Lab:** (0-0-2)
**Semesters Offered:** Fall, Spring, Summer

PE 0220 - Intermediate Alpine Skiing (Downhill)
Intermediate to advanced skills of alpine skiing technique. Skills evaluations and recommendations made for improvement. Own equipment recommended. Daily rental and "rent for the season" equipment available. Season pass required 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 0221 - Intermediate Snowboarding
Intermediate to advanced skills of snowboarding. Skills evaluations and recommendations made for improvement. Own equipment recommended. Daily rental and "rent for the season" equipment available. Season pass required 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 0222 - Alpine Ski Racing
Intermediate to advanced skills of alpine ski racing. Slalom, giant slalom, or super G races weekly. Coaching available. Own equipment recommended. Daily rental and "rent for the season" equipment available. Season pass required 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 0223 - Freestyle (jumps/tricks) Alpine Skiing
Fundamentals of freestyle skiing techniques. Basic skills taught, evaluated, and recommendations made for improvement. Own equipment recommended. Daily rental and "rent for the season" equipment available. Season pass required 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 0224 - Snowboard Racing (Bordercross)
Intermediate to advanced skills of bordercross snowboard racing. Weekly bordercross races. Own equipment recommended. Daily rental and "rent for the season" equipment available. Season pass required 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 0225 - Freestyle (jumps/tricks) Snowboarding
Fundamentals of freestyle snowboarding techniques. Basic skills taught, evaluated, and
recommendations made for improvement. Own equipment recommended. Daily rental and "rent for
the season" equipment available. Season pass required 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 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 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 water polo. 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 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 0235 - Intermediate 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 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 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 0239 - Intermediate 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

PE 0240 - Intermediate 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 half of summer session.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring, Summer

PE 0246 - Intermediate Billiards
Intermediate to advanced techniques, skills, and strategies in billiards. Offered the first and 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 0248 - Intermediate Skating
Intermediate/advanced skills, including three turns, mohawk turns, jumps and spins, and drills for stops, starts, and power skating. Requires own skates. 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 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 Aerobics
Intermediate to advanced techniques and steps involved in aerobics. Requires previous aerobics 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 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 tracks A and B of summer session.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Summer

PE 0270 - Intermediate Tae Kwon Do and Hapkido
Intermediate to advanced techniques, skills, and strategies involved in TaeKwonDo. 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 0300 - Personal Fitness
Client consultation, individual assessment, health history, cardiovascular fitness will be covered. A cardio program will be implemented for each student. Nutrition, stress management, and weight lifting programs will also be taught. Offered fall and spring semesters.
Credits: 1.0; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring

PE 0301 - Military Marksmanship
Develops marksmanship skills through individual practice and competition among individuals and record fire for qualification. Emphasizes awareness of firearm safety and leadership responsibility through marksmanship training. Offered fall and spring semesters.
Credits: 1.0; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring

PE 0306 - Advanced Golf
Learn different types of tournaments. Compete with advanced players and learn proper etiquette in tournament competition. Add to skills in this great lifelong sport. Offered first half of fall semester.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Summer

PE 0315 - 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 0320 - Advanced Skiing
Advanced skills in alpine skiing technique. Own equipment recommended; rental equipment available. Skills evaluated to ensure proper level of proficiency. 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 0321 - Advanced Snowboarding
Advanced skills in snowboarding technique. Own equipment recommended; rental equipment available. Skills evaluated to ensure proper level of proficiency. 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 0340 - Advanced Tennis
Advanced skills and strategy to make play more efficient. Multiple spins on forehand and backhand, ground strokes, drop shots, and different types of serves. Offered the last half of spring semester.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Spring

PE 0355 - Advanced Road Biking
Learn advanced road biking techniques and strategies. Course requires own equipment, including road bike/wheels, bike shorts, biking shoes/pedals, and a helmet. Course also requires sufficient fitness to ride continuously in excess of 15 mph for 1.5 hours. Offered the first half of fall semester.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall
Restrictions: Permission of department required

PE 0415 - Individual Athletics for Seniors
Independent study to help graduating seniors earn their sixth and final co-curricular class activity requirements through aerobic workouts. It is not repeatable. 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, Summer
Restrictions: Permission of department required; May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior

PE 1470 - Lifeguard Swimming
Water strokes and skills required for Lifeguard Training. Requires strong 500-yard continuous swim using front crawl, breaststroke, and sidestroke. Fulfills 1 unit of co-curricular activity.
Credits: 1.0; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall
Co-Requisite(s): EH 2470

PE 1580 - Water Safety Skills
American Red Cross swimming and diving skills required for certification in Water Safety Instructor. Fulfills 1 unit of co-curricular activity.
Credits: 1.0; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Spring
Co-Requisite(s): EH 2580
PE 2000 - Sports Officiating
Students will acquire the fundamental skills, knowledge, and rules necessary for officiating intramural and scholastic softball, football, basketball, ice hockey, and volleyball. Offered fall semester. Fulfills 1 unit of co-curricular activity.
**Credits:** 1.0; Graded Pass/Fail Only
**Lec-Rec-Lab:** (0-0-3)
**Semesters Offered:** Fall

PE 2010 - Varsity Football
Selective collegiate-level sports participation requiring an elite level of skill and extensive time commitment. May count once for co-curricular general education credit.
**Credits:** 1.0; May be repeated; Graded Pass/Fail Only
**Lec-Rec-Lab:** (0-0-5)
**Semesters Offered:** Fall

PE 2020 - Varsity Basketball
Selective collegiate-level sports participation requiring an elite level of skill and extensive time commitment. May count once for co-curricular general education credit.
**Credits:** 1.0; May be repeated; Graded Pass/Fail Only
**Lec-Rec-Lab:** (0-0-5)
**Semesters Offered:** Fall, Spring

PE 2028 - 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. Requires purchase of a season pass for Mont Ripley. Offered first half of spring semester. Fulfills 1 unit of co-curricular activity.
**Credits:** 1.0; Graded Pass/Fail Only
**Lec-Rec-Lab:** (0-0-4)
**Semesters Offered:** Spring

PE 2030 - Varsity Hockey
Selective collegiate-level sports participation requiring an elite level of skill and extensive time commitment. May count once for co-curricular general education credit.
**Credits:** 1.0; May be repeated; Graded Pass/Fail Only
**Lec-Rec-Lab:** (0-0-5)
**Semesters Offered:** Fall, Spring

PE 2040 - Varsity Nordic Skiing
Selective collegiate-level sports participation requiring an elite level of skill and extensive time commitment. May count once for co-curricular general education credit.
**Credits:** 1.0; May be repeated; Graded Pass/Fail Only
**Lec-Rec-Lab:** (0-0-5)
**Semesters Offered:** Spring

PE 2080 - Varsity Track
Selective collegiate-level sports participation requiring an elite level of skill and extensive time commitment. May count once for co-curricular general education credit.
**Credits:** 1.0; May be repeated; Graded Pass/Fail Only
**Lec-Rec-Lab:** (0-0-5)
**Semesters Offered:** Fall, Spring
PE 2090 - Varsity Tennis
Selective collegiate-level sports participation requiring an elite level of skill and extensive time commitment. May count once for co-curricular general education credit.
Credits: 1.0; May be repeated; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-5)
Semesters Offered: Fall, Spring

PE 2130 - Varsity Volleyball
Selective collegiate-level sports participation requiring an elite level of skill and extensive time commitment. May count once for co-curricular general education credit.
Credits: 1.0; May be repeated; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-5)
Semesters Offered: Fall

PE 2140 - Varsity Cross Country
Selective collegiate-level sports participation requiring an elite level of skill and extensive time commitment. May count once for co-curricular general education credit.
Credits: 1.0; May be repeated; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-5)
Semesters Offered: Fall

PE 2150 - Cross Training
A broad base understanding of sports cross training and activities that can be pursued as lifelong activities. May count once for co-curricular general education credit.
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. May count once for co-curricular general education credit.
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. May count once for co-curricular general education credit.
Credits: 1.0; May be repeated; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-5)
Semesters Offered: Fall, Spring
Physics

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: 0.0; May be repeated
Seminers Offered: Fall, Spring
Restrictions: Permission of instructor required

PH 0020 - Team Approach to Learning Physics
Students meet 2 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: 0.0; May be repeated
Seminers Offered: Fall, Spring
Restrictions: Permission of instructor required

PH 1090 - The Physics Behind Music
Physics concepts and methods associated with musical instruments, musical recording, and musical acoustics are discussed at an introductory level. Topics include periodic motion, normal modes and resonance, superposition and Fourier series, waves, sound and acoustics, magnetism and electromagnetic induction, and topics from non-linear physics.

Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Seminers Offered: Fall
Pre-Requisite(s): MA 1032(C) or MA 1031(C)

PH 1100 - Physics by Inquiry I
Experiments covering kinematics, force, conservation of momentum, conservation of energy, and waves are explored through guided construction. The course emphasizes understanding physical concepts through inquiry and the scientific method.

Credits: 1.0
Lec-Rec-Lab: (0-0-2)
Seminers Offered: Fall, Spring, Summer

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)
Seminers Offered: Fall, Spring, Summer
Restrictions: May not be enrolled in one of the following College(s): College of Engineering; May not be enrolled in one of the following Major(s): Applied Physics, Physics
Pre-Requisite(s): (PH 1100(C) or PH 1161(C)) and (MA 1032 or MA 1031 or MA 1135(C) or MA 1140(C) or MA 1150(C) or MA 1160(C) or MA 1161(C))
PH 1111 - College Physics I Laboratory
Experiments covering kinematics, forces, conservation of momentum and energy, waves, and thermodynamics are explored through guided construction. The course provides inquiry-based laboratory experiences for concepts explored in PH1110.

Credits: 1.0
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring, Summer
Restrictions: May not be enrolled in one of the following College(s): College of Engineering; May not be enrolled in one of the following Major(s): Applied Physics, Physics
Co-Requisite(s): PH 1110

PH 1160 - Honors Physics I - Mechanics
Calculus-based introduction to classical mechanics. Topics include mathematical concepts, kinematics, Newton's laws, the gravitational force, work and energy, and collisions. Also introduces departmental facilities and research as well as professional opportunities in physics. The honors course is intended for highly motivated students seeking a challenging introduction to physics.

Credits: 4.0
Lec-Rec-Lab: (4-0-0)
Semesters Offered: Fall
Pre-Requisite(s): PH 1161(C) and (MA 1150(C) or MA 1151(C) or MA 1160(C) or MA 1161(C))

PH 1161 - Introduction to Experimental Physics I
A laboratory complement to PH1160. Experiments covering kinematics, force, conservation of momentum, conservation of energy, waves and thermodynamics are explored through guided construction. The course emphasizes understanding physical concepts through inquiry and the scientific method.

Credits: 1.0
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall

PH 1200 - Physics by Inquiry II
Experiments covering Coulomb's law, electric and magnetic fields, circuits, induction, and geometric optics are explored through guided construction. The course emphasizes understanding physical concepts through inquiry and the scientific method.

Credits: 1.0
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring, Summer
Pre-Requisite(s): PH 1100 or PH 1111 or PH 1161

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
Restrictions: May not be enrolled in one of the following College(s): College of Engineering; May not be enrolled in one of the following Major(s): Applied Physics, Physics
Pre-Requisite(s): PH 1200(C) and PH 1110
PH 1360 - Honors Physics II - Rotation and Vibration
Continuation of PH 1160. Topics include rotational motion, simple harmonic motion and mechanical waves. Offered first half of spring semester.

Credits: 2.0
Lec-Rec-Lab: (4-0-0)
Semesters Offered: Spring
Co-Requisite(s): PH 1361
Pre-Requisite(s): (PH 1160 or PH 2100) and (MA 2150(C) or MA 2160(C))

PH 1361 - Introductory Experimental Physics II
Laboratory complement to PH 1360. Waves, thermodynamics, and electrostatics are explored through guided construction. The course emphasizes understanding physical concepts through inquiry and the scientific method.

Credits: 1.0
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Spring
Co-Requisite(s): PH 1360

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, Spring

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
Co-Requisite(s): PH 1600

PH 2010 - Sophomore Seminar
Discussion of recent research and developments in physics.

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

PH 2100 - University Physics I-Mechanics
A calculus-based introduction to classical mechanics. Topics include kinematics, Newton’s laws, impulse and momentum, work and energy, and the universal law of gravitation.

Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring, Summer
Pre-Requisite(s): PH 1100(C) and (MA 1150 or MA 1151 or MA 1160 or MA 1161) and (MA 2150(C) or MA 2160(C))
PH 2200 - University Physics II-Electricity and Magnetism
A calculus-based introduction to electromagnetism. 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, and electromagnetic waves.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring, Summer
Pre-Requisite(s): (PH 1200(C) or PH 2261(C)) and (PH 2100 or PH 1160) and (MA 2150 or MA 2160)

PH 2230 - Electronics for Scientists
An 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
Restrictions: May not be enrolled in one of the following Major(s): Computer Engineering, Electrical Engineering
Pre-Requisite(s): PH 2200 or PH 2260

PH 2260 - Honors Physics III - Electricity and Magnetism
Calculus-based introduction to electromagnetism. 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: 4.0
Lec-Rec-Lab: (4-0-0)
Semesters Offered: Fall
Pre-Requisite(s): (PH 1160 or PH 2100) and (PH 1200(C) or PH 2261(C)) and (MA 2150 or MA 2160)

PH 2261 - Introduction to Experimental Physics III
A laboratory complement to PH2260. Experiments covering Coulomb's law, electric and magnetic fields, circuits, induction, geometric optics, and modern physics are explored through guided construction. The course emphasizes understanding physical concepts through inquiry and the scientific method.
Credits: 1.0
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall
Pre-Requisite(s): PH 1100 or PH 1161

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, 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. Offered second half of semester.
Credits: 2.0
Lec-Rec-Lab: (4-0-0)
Semesters Offered: Spring
Pre-Requisite(s): PH 1160 or PH 2100
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: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Pre-Requisite(s): PH 2200 or PH 2260

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
Pre-Requisite(s): PH 2400 and (MA 3520 or MA 3521 or MA 3530 or MA 3560)

PH 3111 - Theoretical Mechanics II
A continuation of PH3110. 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
Pre-Requisite(s): PH 3110

PH 3210 - 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: 3.0
Lec-Rec-Lab: (2-0-3)
Semesters Offered: Fall
Pre-Requisite(s): PH 2400 and (MA 3520 or MA 3521 or MA 3530(C) or MA 3560)

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
Pre-Requisite(s): PH 2300 or PH 1360

PH 3320 - Methods of Theoretical Physics
Introduction to the techniques and methods frequently encountered in advanced physics with a particular emphasis on application to physical problems. Topics include, but are not limited to, complex numbers, vector analysis, partial differential equations, and integral transforms.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Pre-Requisite(s): MA 3150 and MA 3530
PH 3410 - Quantum Physics I
An introduction to the foundations of modern physics and Schrodinger's wave mechanics. Topics include thermal radiation, particle-like properties of radiation, Bohr’s model of the atom, matter waves, Schrodinger’s wave mechanics, quantization of angular momentum, and the one-electron atom.

Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Pre-Requisite(s): PH 2400 and (MA 3520 or MA 3521 or MA 3530 or MA 3560)

PH 3411 - Quantum Physics II
A continuation of PH3410. 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: Fall
Pre-Requisite(s): PH 3410

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
Pre-Requisite(s): PH 2230

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: May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior
Co-Requisite(s): PH 4080

PH 4011 - Senior Physics Colloquium II
A continuation of PH4011. 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
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior
Co-Requisite(s): PH 4081
Pre-Requisite(s): PH 4010

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; May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior
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
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior
Co-Requisite(s): PH 4010
Pre-Requisite(s): 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
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior
Co-Requisite(s): PH 4011
Pre-Requisite(s): 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 PH4081.
Credits: 1.0
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Spring
Restrictions: Permission of instructor required; May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior

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: (3-0-0)
Semesters Offered: Fall
Pre-Requisite(s): (PH 2200 or PH 2260) and PH 3110 and (MA 3520 or MA 3521 or MA 3530 or MA 3560)

PH 4211 - Electricity and Magnetism II
A continuation of PH4210. Intermediate study of magnetostatics, electrodynamics, and electromagnetic waves.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Pre-Requisite(s): 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
Pre-Requisite(s): PH 2230 and CS 1010
PH 4390 - Computational Methods in Physics
An overview of numerical and computer methods to analyze and visualize physics problems in mechanics, electromagnetism, and quantum mechanics. Utility and potential pitfalls of these methods, basic concepts of programming, UNIX computing environment, system libraries and computer graphics are included.
Credits: 2.0
Lec-Rec-Lab: (2-0-0)
Semesters Offered: Fall
Pre-Requisite(s): PH 3410

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
Pre-Requisite(s): (PH 3300 or PH 5310) and PH 4390 and (PH 2400 or PH 3410)

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
Pre-Requisite(s): PH 3410 or CH 3520

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
Pre-Requisite(s): (PH 2300 or PH 1360) and PH 2400 and CH 1110 and (MA 3520 or MA 3521 or MA 3530 or MA 3560)

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 2003-2004 academic year
Pre-Requisite(s): PH 1600 and (PH 1360 or PH 2300) and (MA 3520 or MA 3521 or MA 3530 or MA 3560)
**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 2002-2003 academic year  
**Pre-Requisite(s):** PH 1600 and (PH 1360 or PH 2300) and (MA 3520 or MA 3521 or MA 3530 or MA 3560)

**PH 4640 - Introduction to Atmospheric Physics**
Essential elements of atmospheric physics, including atmospheric composition and structure, atmospheric thermodynamics, aerosol and cloud physics, radiative transfer and atmospheric fluid dynamics. MA2300 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 2002-2003 academic year  
**Pre-Requisite(s):** (PH 2200 or PH 2260) and (PH 1360 or PH 2300) and (MA 3150 or MA 3160) and (MA 3520 or MA 3521 or MA 3530 or MA 3560)

**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  
**Semesters Offered:** Fall, Spring, Summer

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**Psychology**

**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 may 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, Summer

**PSY 2100 - Counseling Psychology**
Major approaches used in contemporary counseling psychology, the current status of the profession, and ethical issues encountered will be examined to provide students with a broad understanding of the field. This course does not train students to be counselors.

**Credits:** 3.0  
**Lec-Rec-Lab:** (0-3-0)  
**Semesters Offered:** Spring - Offered alternate years beginning with the 2004-2005 academic year  
**Pre-Requisite(s):** PSY 2000

**PSY 2200 - Behavior Modification**
An introduction to techniques of behavior modification through the application of learning theories such as classical and operant conditioning. Students will conduct a case study project designed to modify a personal behavior.

**Credits:** 3.0  
**Lec-Rec-Lab:** (0-3-0)  
**Semesters Offered:** Fall - Offered alternate years beginning with the 2004-2005 academic year  
**Pre-Requisite(s):** PSY 2000
PSY 2501 - Intro to the Psychology Major: Tools and Technology
Psychology majors examine the field of psychology and major degree requirements resulting in an undergraduate plan of study focused on graduate school admission or career preparation. An introduction to the technological tools used within psychology, including hardware, software, and instrumentation.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Major(s): Psychology
Pre-Requisite(s): PSY 2000(C)

PSY 2720 - Statistics for the Social and Behavioral Sciences
An understanding of statistical concepts and ability to conduct statistical analyses (using both hand calculation and SPSS) as used in Social and Behavioral Sciences research. Topics include descriptive statistics, correlation, and inferential statistics through ANOVA.
Credits: 4.0
Lec-Rec-Lab: (0-4-0)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Major(s): Psychology, Social Sciences, Liberal Arts with History Opt
Pre-Requisite(s): MA 1020 or MA 1032

PSY 3000 - Experimental Methods & Stats
Introduction to experimental design, general research methodology, and the computer analysis and interpretation of data. Emphasizes issues and methods involved in psychological research. Topics include experimental design and validity, choosing appropriate data analysis techniques, and statistical analysis using SPSS.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring
Pre-Requisite(s): PSY 2000 and (MA 2720 or PSY 2720)

PSY 3001 - Experimental Methods and Statistics II
Second course in psychological research methodology and statistics, both experimental and non-experimental. Students design, execute, interpret, and report psychological research.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Major(s): Psychology; May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): PSY 2000 and PSY 3000

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: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): 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 historical and contemporary models used in this field. The student learns the causes and treatment proposed by Cognitive-Behavioral, Psychodynamic and Socialcultural Models with particular emphasis placed on the Diagnostic and Statistical manual used by clinicians for diagnoses.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Summer
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): PSY 2000 and (UN 1002 or UN 1003)

PSY 3040 - History/Systems of Psychology
Traces major historical contributions to current psychology from ancient to modern times. Examines significant ideas and discoveries from philosophy, mathematics, and 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: (0-3-0)
Semesters Offered: On Demand
Pre-Requisite(s): PSY 2000 and UN 2002

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: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): PSY 2000 and (UN 1002 or UN 1003)

PSY 3060 - Physiological Psychology
Technological advances in the field of psychophysiology will serve as the foundation for understanding the application of psychophysiology in areas such as psychopathology, clinical health psychology, the detection of deception, human factors psychology, and environmental design.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): PSY 2000 and UN 2002 and BL 1040

PSY 3070 - Cross-Cultural Psychology
Introduces the student to cross cultural psychology and sociocultural theory as it is applied to psychology. Examines research on cultural specific and universal behaviors. Emphasizes the benefits and challenges of diversity in organizations and diversity skills that promote interpersonal and organizational success.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Pre-Requisite(s): PSY 2000 and (UN 1002 or UN 1003)
PSY 3090 - Directed Research: Undergraduate Research Assistant in Psychology
Directed research in the field of Psychology through the application of research techniques.
Credits: variable to 3.0; May be repeated
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of instructor required; Must be enrolled in one of the following Major(s): Psychology; May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): PSY 2000

PSY 3095 - Teaching Assistant
Undergraduate Teaching Assistant for Principles of Psychology or other Psych course, including tutoring, assessment, test construction.
Credits: variable to 3.0; May be repeated
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of instructor required; Must be enrolled in one of the following Major(s): Psychology
Pre-Requisite(s): PSY 2000

PSY 3160 - Behavioral Neuroscience
A survey of the field of behavioral neuroscience (understanding how the brain controls behavior, perception, and thought). The course will cover the basic structure of the nervous system, research techniques, the motor and sensory systems and complex motivated behaviors such as sleep, reproduction, and eating.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Pre-Requisite(s): PSY 2000 and BL 1040

PSY 3200 - Motivation and Emotion
Introduction to the theoretical, physiological, cognitive, and behavioral factors underlying the processes of motivated behaviors and emotional states. Emphasis is placed on methods for studying motivation and emotion and their role in human behavior.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): PSY 2000

PSY 3260 - Sensation and Perception
The structure and function of human and non-human sensory and perceptual systems will serve as the basis for an examination of the applications of perception research to areas such as virtual reality, human factors engineering, robotics and sports skills training.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): PSY 2000
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, the nature of mental 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: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): PSY 2000 and (UN 1002 or UN 1003)

PSY 4020 - Industrial Organizational Psychology
The psychology of work and organizations. Introduction to the use and application of psychology in the workplace. Focus is on the development of employees and organizational structure, and social behavior including the management of work groups and organizations.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall - Offered alternate years beginning with the 2006-2007 academic year
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): PSY 2000 and UN 2002(C)

PSY 4050 - Psychology of Science and Technology
Applies experimental and cognitive psychology to the endeavors of science, invention, and innovation. This examination of discovery and invention will provide students with an understanding of the application of psychological science to fields such as Business, Engineering, Computer Science, Law and Medicine. Emphasis will be placed on the bridges psychological findings provide to non-psychology fields.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): PSY 2000 and UN 2002

PSY 4080 - Topics in Psychology
An examination of a specific area or approach within the field of Psychology.
Credits: variable to 4.0; May be repeated
Semesters Offered: On Demand
Pre-Requisite(s): 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
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of instructor required; Must be enrolled in one of the following Major(s): Psychology; May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): PSY 2000 and PSY 4000(C)
PSY 4095 - Field Experience in Psychology
Firsthand experience with the application of psychological principles in the field through volunteer placement with a community agency or business. Students are responsible for obtaining field placement site in coordination with instructor. Students complete a comprehensive paper.
Credits: variable to 3.0; Repeatable to a Max of 6
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of instructor required; Must be enrolled in one of the following Major(s): Psychology; May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): PSY 2000 and PSY 2500

PSY 4100 - Environmental Psychology
Psychological effects of the physical environment and effects of human action on the sociophysiological environment, including an examination of global environmental issues and ecologically-relevant behavior.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): PSY 2000 and UN 2002(C)

PSY 4110 - Learning and Memory
Theories of learning and memory from traditional animal research findings, human research, and more recent trends examining the neural basis of learning and memory will be examined to understand changes in behavior, including the acquisition and retention of knowledge.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): PSY 2000

PSY 4120 - Human Factors Psychology
Basic psychological concepts critical to the design of human-technological systems. This class provides an applied perspective of psychological research and insight into the most unpredictable and error-prone component of human-machine systems - the human! Appropriate for both psychology and engineering students.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall - Offered alternate years beginning with the 2007-2008 academic year
Pre-Requisite(s): PSY 2000

PSY 4220 - Psychology and Law
Application of psychological principles to legal concerns and the interaction of psychology and law. Topics include perception, memory, and decision-making processes as applied to eyewitnesses, identification and evaluation of suspects, jury trials, capital punishment, and other current topics.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2005-2006 academic year
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): PSY 2000
PSY 4500 - Senior Seminar: Psychology Capstone
Focusing on career preparation or application to graduate programs, an intensive exploration into an aspect (e.g., teaching, service, research) and area (e.g., experimental, developmental, clinical) of psychology will enhance learning and unify knowledge and experiences acquired as a psychology major.

Credits: 2.0
Lec-Rec-Lab: (0-2-0)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Major(s): Psychology; May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): PSY 4000 and PSY 4001

Sciences and Arts

SA 1000 - Sciences and Arts Explorations
Exploration of majors and related career opportunities. Includes an introduction to University resources such as the Career Center, presentations by experts, an examination of individual interests and abilities, opportunities for discussion and reflection, and guidance in choice of appropriate courses.

Credits: 1.0
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Major(s): General Sciences and Arts

Systems Admin. Technology

SAT 1610 - Computer and OS Architecture
Fundamentals of computer organization, operating system architecture, PC/WS major subassemblies, PC and server configuration planning, power interfaces, system assembly/set-up, connection of peripherals, installing fundamental operating system software, system testing/debugging and planning and installation of application software portfolio.

Credits: 3.0
Lec-Rec-Lab: (2-0-2)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Major(s): Computer Network & System Admin

SAT 1700 - Computer-Cyber Ethics/Policy
Ethical, privacy, liability, and regulatory compliance issues in managing computer and network administrations. Other topics include the digital ID debate, biometrics, computer use policy, privacy statements, P3P, security policy, FCC mandates, state utility commission mandates, W3C, standards development bodies.

Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Major(s): Computer Network & System Admin
SAT 2343 - Network Administration I
Introduction to basic networking concepts and implementation. Topics include OSI model, subnetting, network addressing, data encapsulation, network topologies, administration UNIX and NT systems running TCP/IP, and basic configuration of networking hardware including cabling, bridges, routers, and other communications.
Credits: 4.0
Lec-Rec-Lab: (0-3-2)
Semesters Offered: Fall
Pre-Requisite(s): SAT 1610

SAT 2400 - Scripting Programming
Emphasizes the fundamentals of scripting programming, testing, implementation and documentation (i.e. PERL, PHP, Python, Shell Scripting). Other topics include language syntax, data and file structures, input/output devices, file and graphical user interfaces.
Credits: 3.0
Lec-Rec-Lab: (2-0-2)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Major(s): Computer Network & System Admin; May not be enrolled in one of the following Class(es): Freshman

SAT 2511 - MS System Administration I
Microsoft server software installation and configuration. Development of system interface scripts to perform tasks specific to client/server applications. Other topics include RDP, directory services, device drivers, SLIP/PPP, and SAN/NAS access.
Credits: 4.0
Lec-Rec-Lab: (0-3-2)
Semesters Offered: Spring
Pre-Requisite(s): SAT 2343 or SAT 2341

SAT 2600 - Mobile Computing and FCC Regulations
Evolution of the wired and wireless communications industry, industry standards, and regulations. Key topics include Wi-Fi 802.11x, Bluetooth 802.15.1, Zigbee Mesh 802.15.4, Passive RFID tags, cellular GSM, GPRS & CDMA protocols, and PDA platforms/OS's (i.e. Palm, MS, Research in Motion, and Symbian).
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Spring
Pre-Requisite(s): SAT 2343 or SAT 2341

SAT 2711 - Unix & Linux Administration I
Study of networked systems in a UNIX, Linux and Mac OS X environment. Topics include system kernel, SSH, utilities, process management, backup/restore, adding devices, and networking hardware including cabling, modems, routers, communication devices, ethernet, TCP/IP, and networking protocols.
Credits: 4.0
Lec-Rec-Lab: (0-3-3)
Semesters Offered: Fall, Spring
Pre-Requisite(s): SAT 1610
SAT 3343 - Network Administration II
Study of networked routers and switches. Topics include TCP/IP, ICMP, router passwords, access-lists, remote network structures, network topologies, telnet and SSH authentication, switch programming, VLAN and STP configuration, loading IOS flash, IP traffic control, network troubleshooting, and WAN encapsulation.

Credits: 4.0
Lec-Rec-Lab: (0-3-3)
Semesters Offered: Fall
Pre-Requisite(s): SAT 2343 or SAT 2341

SAT 3511 - MS System Administration II
Advanced MS administration functions. Topics include TCP/IP infrastructures, managing storage, grid and clustered computing, configuring print servers, Windows terminal server, connecting Macintoshes to Windows, integrating Netware to Windows, MS system tuning, remote access, and back up and recovery from failures.

Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Fall
Pre-Requisite(s): SAT 3441 or SAT 2511

SAT 3711 - Unix & Linux Administration II
Advanced study of UNIX and Linux OS. Topics include system management, installation and maintenance, network security, data integrity, and enterprise infrastructures such as identity management, authentication, authorization and directory services.

Credits: 3.0
Lec-Rec-Lab: (2-0-2)
Semesters Offered: Spring
Pre-Requisite(s): SAT 3341 or SAT 2711

SAT 3812 - Network Security Engineering I
Planning and managing system security in a TCP/IP converged enterprise network environment. Topics include security architecture, patch management, performance monitoring, security management tools, best practices, policy management, virus scanning, security protocols, intrusion detection, firewalls, and SSL/TLS.

Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Spring
Pre-Requisite(s): SAT 2511 and SAT 2711

SAT 4200 - Storage Area Networking
Study of distributed network storage methods, that is iSCSI, DAS, NAS, and SAN technologies. Other topics include storage and compute virtualization, configuration management, storage farms, backup and recovery.

Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Fall
Pre-Requisite(s): SAT 2511 and SAT 2711
SAT 4343 - Network Engineering
Topics include router and switch flow control; VoIP, compression and load balancing; VPN networks involving MPLS, IPSEC and PPP; advanced access-list configuration; AAA; Kerberos; TACACS; Firewalls; and configuration of routing protocols such as RIP, EIGRP, OSPF, IS-IS and BGP.

Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Fall, Spring
Pre-Requisite(s): SAT 4341 or SAT 3343

SAT 4480 - Senior Project I
Capstone course requiring the application of knowledge gained in lower division courses. Projects are team oriented, require weekly progress reports, and culminate with a final report and oral presentation.

Credits: 3.0
Lec-Rec-Lab: (0-0-6)
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of instructor required; Must be enrolled in one of the following Major(s): Computer Network & System Admin; May not be enrolled in one of the following Class(es): Freshman, Sophomore

SAT 4541 - Windows 2000 Directory Services
Advanced concepts of planning and implementing Microsoft Windows 2000 Active Directory and LDAP directory in an enterprise environment.

Credits: 3.0
Lec-Rec-Lab: (2-0-2)
Semesters Offered: Fall, Spring
Pre-Requisite(s): SAT 3511 and SAT 3711

SAT 4600 - Web/App Server Administration
Fundamentals of web and application server administration. Topics include server configuration, load balancing, connecting to the internet, web security and administration, communication media, backing up, fault tolerance, and proxy servers. In depth study of Apache web server and Microsoft’s Internet Information Server.

Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Fall
Pre-Requisite(s): SAT 3511 and SAT 3711

SAT 4812 - Network Security Engineering II
Cryptographic, authentication, key distributions, and e-commerce security protocols. Security protocol properties: authentication, secrecy, integrity, availability, non-repudiation, atomicity, certified delivery; crypto-protocol attacks; security protocols design, implementation and analysis. Email, IP, and wireless security, virtual private networks, firewalls, content filtering, network security policies, and intrusion detection.

Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Spring
Pre-Requisite(s): (SAT 3812 or SAT 4811) and MA 3203
SAT 4880 - Senior Project II
Capstone course requiring the application of knowledge gained in lower division courses. Projects are team oriented, require weekly progress reports, and culminate with a final report and oral presentation.
Credits: 2.0
Lec-Rec-Lab: (0-0-4)
Semesters Offered: Fall, Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): SAT 4480

SAT 4999 - Professional Practices
Covers project management and professional practices as applied to the CNSA technology field. Discusses application of systems analysis to project definition and selection. Includes project teams and interactions, project planning, scheduling and control tools. Emphasizes use of computers.
Credits: 1.0
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Fall, Spring
Restrictions: Must be enrolled in one of the following Major(s): Computer Network & System Admin;
Must be enrolled in one of the following Class(es): Senior
Pre-Requisite(s): SAT 4480

Social Sciences

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
Restrictions: Must be enrolled in one of the following Major(s): Social Sciences, Liberal Arts with History Opt

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: 2.0
Lec-Rec-Lab: (2-0-0)
Semesters Offered: Spring

SS 2100 - World Peoples & Environments
Introduction to two major disciplines, anthropology and geography, that focus on human diversity and the human relationship to environment and resources. Emphasizes patterns of culture and nature at different scales of human organization.
Credits: 3.0
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, Progressives 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, Spring

**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:** Fall, Spring

**SS 2610 - Introduction to Law and Society**  
Examining the civil and criminal justice system to explain how law informs yet is shaped by political, economic, and social forces. This course covers issues such as individual rights, the jury system, tort law, legal reform movements and constitutional interpretation.  
**Credits:** 3.0  
**Lec-Rec-Lab:** (3-0-0)  
**Semesters Offered:** Spring - Offered alternate years beginning with the 2006-2007 academic year  
**Pre-Requisite(s):** UN 1002(C) or UN 1003(C)

**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, Spring

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 2000-2001 academic year
Pre-Requisite(s): UN 1002 or UN 1003

SS 3200 - Historical Archaeology
Introduction to historical 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
Pre-Requisite(s): UN 1002 or UN 1003

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; Repeatable to a Max of 8
Semesters Offered: Summer
Pre-Requisite(s): UN 1002 or UN 1003

SS 3211 - Ethnographic Methods
Field-based course that surveys basic concepts of ethnography and applies them in a class-based research project. Provides practical experience in field observation, interviews, oral history, field notes, and write-up of research.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2007-2008 academic year
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): UN 2002
SS 3220 - Archaeological Sciences
Introduction to the archaeological sciences, including geo/bioarchaeology and materials science. Lectures emphasize connections between field and laboratory, and scientific and environmental perspectives on the world’s peoples and cultures, both ancient and industrial. Students undertake hands-on exploration through course laboratory component.

Credits: 4.0
Lec-Rec-Lab: (3-0-3)
Semesters Offered: Fall - Offered alternate years beginning with the 2006-2007 academic year
Pre-Requisite(s): SS 2200 and (UN 1002 or UN 1003)

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: Fall
Pre-Requisite(s): UN 1002 or UN 1003

SS 3240 - Reading the Landscape: Anthropology, Geography, History
Landscape is a lens through which scholars study people, environment, and place. The concept transcends traditional disciplinary boundaries. Students will read and discuss different approaches to landscape, with special focus upon anthropological, geographic, and historical perspectives.

Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall - Offered alternate years beginning with the 2007-2008 academic year
Pre-Requisite(s): UN 2002

SS 3300 - Environmental Problems
An 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
Pre-Requisite(s): UN 2002

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 - Offered alternate years beginning with the 2002-2003 academic year
Pre-Requisite(s): 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 - Offered alternate years beginning with the 2001-2002 academic year
Pre-Requisite(s): UN 2002

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
Pre-Requisite(s): 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
Pre-Requisite(s): 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: Fall, Spring - Offered alternate years beginning with the 2006-2007 academic year
Pre-Requisite(s): UN 2002

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: Spring - Offered alternate years beginning with the 2005-2006 academic year
Pre-Requisite(s): UN 2002

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
Pre-Requisite(s): 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 - Offered alternate years beginning with the 2000-2001 academic year
Pre-Requisite(s): UN 2002

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: Fall
Pre-Requisite(s): UN 2002

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: Fall - Offered alternate years beginning with the 2001-2002 academic year
Pre-Requisite(s): 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: Fall, Spring, Summer
Pre-Requisite(s): 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
Pre-Requisite(s): 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
Pre-Requisite(s): 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: Fall - Offered alternate years beginning with the 2002-2003 academic year  
Pre-Requisite(s): 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: Fall  
Pre-Requisite(s): UN 1002 or UN 1003

SS 3561 - History of England II  
The 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  
Pre-Requisite(s): UN 1002 or UN 1003

SS 3570 - History of Canada  
The 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  
Pre-Requisite(s): UN 1002 or UN 1003

SS 3580 - Technology and Western Civilization  
An 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: Fall - Offered alternate years beginning with the 2000-2001 academic year  
Pre-Requisite(s): UN 2002

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: Fall, Spring - Offered alternate years beginning with the 2000-2001 academic year  
Pre-Requisite(s): UN 2002
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 case, and engage in a moot court.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall - Offered alternate years beginning with the 2000-2001 academic year
Pre-Requisite(s): UN 2002

SS 3620 - International Environmental Technology Policy
Explores the relationship between markets and government policies in moving national economies and corporations toward "greener" technology choices. Topics may include industrial ecology, regulation, innovation, and 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: Fall, Spring - Offered alternate years beginning with the 2001-2002 academic year
Pre-Requisite(s): UN 2002

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: Fall
Pre-Requisite(s): UN 2002

SS 3640 - Selected Topics in Cyber-Law
Applies legal and ethical principles to evolving computer technology. Explores current legal issues such as surveillance, privacy, free speech, crime, encryption, on line contracting, intellectual property and censorship, as well as legislative efforts to resolve these and other computing dilemmas.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall - Offered alternate years beginning with the 2005-2006 academic year
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): UN 2002

SS 3650 - Fundamentals of Intellectual Property Law
Introduces basic principles and law of Intellectual Property. Covers law and contemporary policy issues involving copyright, trademarks, trade secrets and patents. Emphasizes learning through use of practical examples, case studies and hands on simulations in addition to lectures.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall - Offered alternate years beginning with the 2006-2007 academic year
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): UN 2002
SS 3660 - American Constitutional Law
Introduces the U.S. Constitution and how it has been interpreted by the Supreme Court over time. Explores historical, social and political consequences of major constitutional themes such as federalism, judicial review, and evolving view of individual rights and liberties.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2005-2006 academic year
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): UN 2002 and (SS 2600(C) or SS 2610(C))

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: Fall - Offered alternate years beginning with the 2002-2003 academic year
Pre-Requisite(s): UN 2002

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 - Offered alternate years beginning with the 2002-2003 academic year
Pre-Requisite(s): UN 2002

SS 3720 - Social Psychology
Survey of social, cultural, 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
Pre-Requisite(s): UN 2002

SS 3740 - Sociology of 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. Students should have completed six credits in Social Sciences to be successful in this course.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): UN 2002
SS 3750 - Social Inequality
A 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 2001-2002 academic year
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): UN 2002

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)
Semesters Offered: Fall
Pre-Requisite(s): 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 2001-2002 academic year
Pre-Requisite(s): UN 2002

SS 3810 - Anthropology of Science and 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 choice.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2001-2002 academic year
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): UN 2002

SS 3820 - Societal Implications of Nanotechnology
Consideration of the social, economic, political, and ethical aspects of the emergent science and engineering for nanotechnology.
Credits: 2.0
Lec-Rec-Lab: (2-0-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2005-2006 academic year
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): UN 2002
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, toxics regulation, and political debate.
Credits: 3.0
Lec-Rec-Lab: (1-2-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2000-2001 academic year
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): 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 - Offered alternate years beginning with the 2001-2002 academic year
Pre-Requisite(s): 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
Pre-Requisite(s): UN 1002 or UN 1003

SS 3920 - Topics in Anthropology/Archaeology
Survey of a major branch of American anthropology or archaeology, or a specific time period or region. Topics may include North American prehistory, experimental archaeology, applied anthropology, economic anthropology, or other specialized themes. Readings will emphasize both theoretical and substantive contributions. May be repeated if topics differ.
Credits: 3.0; Repeatable to a Max of 9
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Pre-Requisite(s): 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
Pre-Requisite(s): 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
Pre-Requisite(s): 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
Pre-Requisite(s): 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
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: variable to 3.0; Repeatable to a Max of 9
Semesters Offered: On Demand
Pre-Requisite(s): 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
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of instructor required

SS 4001 - History of Social Thought
An intensive survey of the literature of 19th-20th century history of social thought, including the writings of Marx, Durkheim, Weber, and other prominent anthropologists, sociologists, and political philosophers.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2006-2007 academic year
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): UN 2002
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. Students should have completed six credits of Social Sciences to be successful in this course.
Credits: 4.0
Lec-Rec-Lab: (3-1-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2000-2001 academic year
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): UN 2002 and (PSY 2720 or MA 2720 or BA 2100)

SS 4020 - Methods of Teaching Social Studies
Application of learning and instructional theories and practice to the teaching of social studies. Emphasis will include application of state and national education standards and relevant assessment strategies for social studies. Requires admission in the Teacher Education program by the Department of Education.
Credits: 2.0
Lec-Rec-Lab: (0-2-0)
Semesters Offered: Spring
Restrictions: Permission of department required; May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior
Pre-Requisite(s): ED 4700(C)

SS 4030 - Senior Project
Supervised research project as a capstone to a major. Students work with faculty member on design, research, and written report for a project defined by the student’s interest and/or major.
Credits: 3.0; May be repeated
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Restrictions: Must be enrolled in one of the following Class(es): Senior
Pre-Requisite(s): 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 2007-2008 academic year
Pre-Requisite(s): UN 2002

SS 4200 - Environmental Anthropology
A seminar on the study of culture and politics in marginal environments and disadvantaged communities. Draws upon research in anthropology and geography to examine the interaction in the Americas, Asia, Africa, Europe, the Pacific, and the Arctic.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: On Demand
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): SS 2100
SS 4405 - Geophysics for Archaeology
Principles and practice of non-invasive archaeological geophysics such as magnetometry, ground penetrating radar, and resistivity. Data interpretation will involve basic computation, computer and hand contouring, three-dimensional visualization programs, interpretation and archaeological significance. Activities will involve fieldwork, work on data, and short reports. The mathematical content of the class will be minimal.

Credits: 3.0
Lec-Rec-Lab: (2-0-1)
Semesters Offered: Fall - Offered alternate years beginning with the 2004-2005 academic year

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 2001-2002 academic year
Pre-Requisite(s): UN 1002 or UN 1003

SS 4510 - Sustainable Futures I
Covers introductory and intermediate concepts of Sustainable Development. Explores methods/tools for assessing sustainability (economic, environmental, societal impacts) of current and emerging industrial technologies. Explores relationships between government policies and markets for introducing sustainable technologies into national economies and corporations.

Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): UN 2002

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: variable to 3.0; Repeatable to a Max of 9
Semesters Offered: On Demand
Pre-Requisite(s): 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: Fall
Restrictions: Must be enrolled in one of the following Major(s): Social Sciences, Liberal Arts with History Opt; May not be enrolled in one of the following Class(es): Freshman, Sophomore

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
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 Opt
Surveying

**SU 2000 - Surveying and GIS Fundamentals**
Surveying topics will include distance measurements, leveling, angles, directions, traversing, horizontal and vertical curves, percent grade, and coordinate geometry. GIS topics will include sources of GIS data, spatial data models, GIS data structures, GIS topology, as well as query and feature selection in GIS.

Credits: 2.0  
Lec-Rec-Lab: (0-1-2)  
Semesters Offered: Fall, Spring  
Restrictions: May not be enrolled in one of the following Major(s): Surveying

**SU 2120 - Computer Aided Drafting for Surveying**
Introduction to surveying applications using CAD. Topics include: Entering traverse data, adjusting traverses, coordinating geometry routines, designing and annotating plats, creating topographical maps, calculating earthwork volumes, creating alignments and generating profiles.

Credits: 2.0  
Lec-Rec-Lab: (0-1-2)  
Semesters Offered: Spring  
Pre-Requisite(s): TE 1110

**SU 2150 - Fundamentals of Surveying**
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: 4.0  
Lec-Rec-Lab: (0-2-6)  
Semesters Offered: Fall

**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, and unequal-tangent vertical curves. Other topics include horizontal and vertical alignment design, earthwork quantities and mass diagrams.

Credits: 3.0  
Lec-Rec-Lab: (0-3-0)  
Semesters Offered: Spring  
Pre-Requisite(s): SU 2150 or SU 2000

**SU 2260 - Survey Computations and Regulations**
Introduction to the PLSS system, legal descriptions, and basic statutes governing the practice of surveying. Introduction to and practice reducing field notes, making survey computations, and preparing various types of survey maps.

Credits: 3.0  
Lec-Rec-Lab: (0-2-3)  
Semesters Offered: Spring  
Pre-Requisite(s): SU 2150 and SU 2120

**SU 3110 - Surveying Field Practice**
Students enrolled in this course perform several survey projects from field to finish using conventional surveying equipment and software. A continuation of SS2100 and SS2260.

Credits: 4.0  
Lec-Rec-Lab: (0-2-6)  
Semesters Offered: Fall  
Pre-Requisite(s): SU 2260 and SU 2220
**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:** 3.0  
**Lec-Rec-Lab:** (0-3-0)  
**Semesters Offered:** Fall  
**Restrictions:** May not be enrolled in one of the following Class(es): Freshman, Sophomore  
**Pre-Requisite(s):** (MAT 1195 or MA 1140 or MA 1150 or MA 1151 or MA 1160 or MA 1161) and SU 3110(C)

**SU 3180 - Boundary Surveying Principles**
Interpretation of property descriptions used to establish land boundaries. Resolving conflicts in boundary descriptions as well as conflicts in evidence. Review doctrines pertaining to transferring title, the role of the surveyor in issuing opinions on boundary location in boundary disputes.

**Credits:** 3.0  
**Lec-Rec-Lab:** (0-2-3)  
**Semesters Offered:** Fall  
**Pre-Requisite(s):** SU 2260

**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:** (0-2-2)  
**Semesters Offered:** Spring  
**Restrictions:** May not be enrolled in one of the following Class(es): Freshman, Sophomore  
**Pre-Requisite(s):** (MA 2320 or MA 2321 or MA 2330 and (MA 2720) or MA 2710 or MA 3710) and SU 3110

**SU 4100 - Geodetic Positioning**
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:** May not be enrolled in one of the following Class(es): Freshman, Sophomore  
**Pre-Requisite(s):** SU 3150 and SU 3250

**SU 4140 - Photogrammetry**
Basic principles of photogrammetry and its role as a technology for spatial data collection. Use of photogrammetry in the fields of surveying, engineering, and geographic information management will be discussed.

**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  
**Pre-Requisite(s):** SU 3110
SU 4180 - Land Subdivision Design
Introduces the physical, economic, and social aspects of optimum land use within the framework of state and local regulations of land divisions, condominiums, mobile home parks, and residential subdivisions.

Credits: 3.0
Lec-Rec-Lab: (0-2-1)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): SU 3180

SU 4220 - Ethics and Professional Practice
Discuss regulations of the surveying profession via state licensure and tort principles. Introduction to professional ethics and the surveying industry. Introduction to basic contracts and agency law.

Credits: 2.0
Lec-Rec-Lab: (0-2-0)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): SU 4180 or SU 4280

SU 4240 - Introduction to Geographic and Land Information Systems
Covers the fundamentals of Geographic Information Systems (GIS). Emphasis is on the application of GIS principles for infrastructure and land parcel management. An introduction to the concept multipurpose cadastre also will be presented.

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
Pre-Requisite(s): SU 3150 and SU 4140

SU 4999 - Professional Practice Seminar
This course will be used to assess student learning outcomes and prepare students to sit for the NCEES Fundamentals of Land Surveying examination.

Credits: 1.0
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Class(es): Senior
Co-Requisite(s): SU 4180
Technology

TE 1110 - Introduction to AutoCAD
Introduction to the AutoCAD software package. Topics include setting up a drawing, creating and editing geometric entities, hatching, layering, adding text, dimensioning, incorporating blocks and attributes, merging drawings, laying out views, and plotting.
Credits: 2.0
Lec-Rec-Lab: (0-1-2)
Semesters Offered: Fall

TE 1200 - Computer Applications in Technology Industry
An introduction to the computer applications tools used in technology. Focuses on skills needed for problems encountered in technology industries, including tools for technical communications, simulation, and analysis.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Fall, Spring
Restrictions: Must be enrolled in one of the following College(s): School of Technology

TE 2000 - Directed Study in Technology
Students undertake a directed study in an approved technology topic under the guidance of a School of Technology faculty member. The course of study will be academic in nature and is decided upon between the student and the faculty member.
Credits: variable to 3.0; Repeatable to a Max of 6
Semesters Offered: On Demand
Restrictions: Permission of instructor and department required; Must be enrolled in one of the following College(s): School of Technology; May not be enrolled in one of the following Class(es): Junior, Senior

TE 3956 - Industrial Safety Management
Occupational safety and health standards and codes. Hazard recognition, accident costs, accident prevention, ethics and administration.
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

TE 4000 - Independent Study in Technology
Students undertake an independent study in an approved technology topic under the guidance of a School of Technology faculty member. The course of study may either be research or academic and is decided upon between the student and faculty member.
Credits: variable to 3.0; Repeatable to a Max of 6
Semesters Offered: On Demand
Restrictions: Permission of instructor and department required; Must be enrolled in one of the following College(s): School of Technology; May not be enrolled in one of the following Class(es): Freshman, Sophomore
TE 4001 - Special Topics in Technology
Topics of special interest in technology will be offered depending on student demand and faculty expertise.
Credits: variable to 4.0; Repeatable to a Max of 8
Semesters Offered: On Demand
Restrictions: Permission of instructor and department required; Must be enrolled in one of the following College(s): School of Technology

University Wide

UN 1000 - Frameworks 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
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Summer

UN 1001 - Perspectives on Inquiry
Writing-intensive course which engages students in college level inquiry. Students develop fundamental intellectual habits, understand how to integrate various 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, Summer
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: (3-0-3)
Semesters Offered: Spring, Summer
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 1010 - Creating Your Success
Introduction to strategies for creating academic, professional and personal success. Emphasis is on determining individual priorities, improving self-management and developing critical thinking skills. Guided journal writing will be used to explore these strategies.
Credits: 1.0; Repeatable to a Max of 3; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring, Summer
UN 2001 - Revisions: Oral, Written, and Visual Communication
Oral, Written, and Visual Communication. Writing-intensive course which builds on students’ previous courses by providing advanced, direct instruction in communication. Students look closely at the communication practices of civic groups and apply what they learn to their own spoken, written, and visual work. Class projects ask students to fit the communications they make to interesting, sometimes difficult, situations and audiences.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring, Summer
Restrictions: Must be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): 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, Summer
Restrictions: Must be enrolled in one of the following Class(es): Sophomore

UN 2600 - Fundamentals of Nanoscale Science and Engineering
Team-taught introduction to the fundamentals of nanotechnology, emphasizing the interdisciplinary nature of this field. Modern instrumentation, key scientific foundations, and current and potential applications will be discussed. Real and potential societal implications of nanotechnology will be explored.
Credits: 2.0
Lec-Rec-Lab: (1-1-0)
Semesters Offered: Spring

UN 2990 - Special Topics - Interdiscip.
The study of interdisciplinary special topics as specified by section title.
Credits: variable to 6.0; Repeatable to a Max of 97
Semesters Offered: On Demand
Restrictions: Permission of instructor required

UN 3002 - Undergraduate Cooperative Education Laboratory
Credits may count as free or technical electives based on student’s academic department. Requires 2.20 GPA or better, registration with the Office of Cooperative Education, and acceptability by a recognized employer. Transfer students must have completed at least one full-time semester on the MTU campus.
Credits: variable to 2.0; May be repeated
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of instructor and department required; May not be enrolled in one of the following Level(s): Graduate; Must be enrolled in one of the following Class(es): Sophomore, Junior, Senior
UN 3003 - Undergraduate Cooperative Education Laboratory – Technical Elective
Reserved for co-op assignments requiring additional or specialized training. Permission of the Co-op office and academic department is required. Requires GPA 2.20 or better, registration with the Office of Cooperative Education, and acceptability by a recognized employer. 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, Summer
Restrictions: Permission of instructor and department required; May not be enrolled in one of the following Level(s): Graduate; Must be enrolled in one of the following Class(es): Sophomore, Junior, Senior

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: May not be enrolled in one of the following Class(es): Freshman, Sophomore

UN 4990 - Special Topics - Interdisciplinary
Study of interdisciplinary special topics as specified by section title.

Credits: variable to 6.0; May be repeated
Semesters Offered: On Demand
Restrictions: Permission of instructor required
Appendix A: Refund/Repayment Policies

Refunds of Tuition/Fees

Students will be assessed tuition and fees according to the number of credits for which they are registered on Wednesday of the second week of the semester. Credits added after this date will be assessed tuition, but financial aid will not be adjusted.

Schedule adjustments—Courses dropped by the close of business on Wednesday of the second week of the semester will be refunded 100 percent for tuition and fees. Courses dropped after this time for students who otherwise remain enrolled at MTU will not be refunded, and additional tuition and fees will be incurred if credits are added.

Half semester courses, including most summer semester courses, or any other courses offered in a time module other than a fourteen week semester will be prorated according to the refund schedule and the equivalent percentage of time.

Refund dates for half semester and full semester courses are posted on the Academic Calendar. Refer to the Schedule Planning Center at www.admin.mtu.edu/em/students/plan/ or contact the Office of Student Records and Registration for information on refund dates for all other courses.

University Withdrawal—The following refund schedule applies when students drop all classes and leave the University. This does NOT apply to students making schedule adjustments who otherwise remain enrolled at MTU.

Students receive 100 percent refund of tuition and fees when all classes are dropped prior to the first day of the semester.

Refunds for classes offered in a time module other than a fourteen week semester will be prorated according to this schedule and the equivalent percentage of time.

<table>
<thead>
<tr>
<th>Time of Withdrawal</th>
<th>Refund Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Through Wednesday of the first week</td>
<td>100%</td>
</tr>
<tr>
<td>Thursday and Friday of 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>
</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 will be deducted from the refund of the deposit.

Credit Balance Refunds—Credit balance refunds as a result of financial aid or overpayment will be issued during the third week of the semester. Credit balances as a result of Federal Direct Loan proceeds will be refunded when the credit appears on the student’s account. Refund checks cannot be picked up in the Cashier’s or Accounting Offices. Checks are mailed or direct deposited into the student’s checking or savings account.
It is the student’s responsibility to maintain correct addresses. Mailing addresses (local address where refund checks will be sent) may be updated through Banweb (Student Information System).

A $10.00 fee will be assessed to the student’s account if he or she requests a stop payment and reissue of a credit balance check within fifteen days from the date of issue. No fee will be assessed if the request comes fifteen days or later after the date of issue.

**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:

\[
\text{Percent of Title IV aid earned} = \frac{\text{Number of days completed by the student}}{\text{Total number of days in the semester}^*}
\]

* The total number of days in the semester includes weekends, but does not include any scheduled breaks of more than five days.

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

Students will be assessed tuition and fees according to the number of credits for which they are registered on Federal financial aid regulations require students to make satisfactory progress to remain eligible for financial aid. Financial aid programs affected by this policy include Federal Pell Grants, Federal Perkins Loans, Federal and Michigan Work-Study, Federal and Michigan Educational Opportunity Grants, Federal Direct Subsidized Loans, Federal Direct Unsubsidized Loans, Federal PLUS Loans, Michigan Competitive Scholarships, the Michigan Adult Part-time Grants, and Michigan Tuition Incentive Program.

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 passed after spring semester are not considered to be making satisfactory progress. Both GPA and credits passed 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 Passed
Every student must adhere to the following schedule of credits passed, 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>Undergraduate Student</th>
<th>MS Student</th>
<th>PhD Student</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>9</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>1.5*</td>
<td>13</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>2</td>
<td>18</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>3</td>
<td>28</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td>4</td>
<td>38</td>
<td>16</td>
<td>16</td>
</tr>
<tr>
<td>5</td>
<td>49</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>6</td>
<td>60</td>
<td>24</td>
<td>24</td>
</tr>
<tr>
<td>7</td>
<td>71</td>
<td>28</td>
<td>28</td>
</tr>
<tr>
<td>8</td>
<td>82</td>
<td>32</td>
<td>32</td>
</tr>
<tr>
<td>9</td>
<td>94</td>
<td>no aid</td>
<td>36</td>
</tr>
<tr>
<td>10</td>
<td>106</td>
<td>—</td>
<td>40</td>
</tr>
<tr>
<td>11</td>
<td>118</td>
<td>—</td>
<td>44</td>
</tr>
<tr>
<td>12</td>
<td>130</td>
<td>—</td>
<td>48</td>
</tr>
<tr>
<td>More than 12</td>
<td>no aid</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>13</td>
<td>—</td>
<td>—</td>
<td>52</td>
</tr>
<tr>
<td>14</td>
<td>—</td>
<td>—</td>
<td>56</td>
</tr>
<tr>
<td>More than 14</td>
<td>—</td>
<td>—</td>
<td>no aid</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 official add period. 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 passed 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 passed 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 passed 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 semesters). 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 credits passed for undergraduate students.

Graduate Students—Credits passed 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 submitting a Satisfactory Progress Appeal Request Form along with the specified documentation. This form can be obtained from the Financial Aid Office or downloaded from the Financial Aid Office website. Appeals should be submitted to the Financial Aid Office no later than Tuesday of the first week of the semester following unsatisfactory progress. If a student’s appeal is approved, when appropriate, the full-time semesters will be adjusted 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.

Financial Aid

For scholarship information, go to the Financial Aid website at www.admin.mtu.edu/finaid/finaid.htm.
Appendix C: 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 and student life by measuring the success of students as a group. The university also participates in national surveys, such as the National Survey on Student Engagement.

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.)

David J. Brule, Sr., Iron Mountain, Michigan . . . . . . . . . . .2001–2008
Kathryn I. Clark, Ann Arbor, Michigan . . . . . . . . . . . . . . . .2005–2012
Russell A. Gronevelt, Plymouth, Michigan . . . . . . . . . . . .2004–2010
Michael C. Henricksen, AuTrain, Michigan . . . . . . . . . . . .2001–2006
Rodger A. Kershner, Grosse Pointe, Michigan . . . . . . . . . . .2001–2008
Norman A. Rautiola, Santa Barbara, California . . . . . . . . . . .2002–2006
Ruth A. Reck, Davis, California . . . . . . . . . . . . . . . . . . . . .2002–2010
Martha K. Richardson, Grosse Pointe Park, MI . . . . . . . .2005–2012

University Administrators

President, Glenn D. Mroz
  Provost and VP for Academic Affairs, David D. Reed
  VP for Student Affairs, Les P. Cook
  VP for Administration, Ellen S. Horsch
  VP for Advancement, Shea McGrew
  VP for Governmental Relations; Sec'y, Board of Control, Dale R. Tahtinen
  VP for Research, David D. Reed
  Chief Financial Officer/Treasurer, Board of Control, Daniel D. Greenlee

Faculty Administration

College of Engineering
  Dean, Robert O. Warrington, Jr.
  Associate Dean, Sheryl A. Sorby
Department Chairs
Biomedical Engineering, Michael R. Neuman
Chemical Engineering, Michael E. Mullins
Civil and Environmental Engineering, Neil J. Hutzler
Electrical and Computer Engineering, Timothy J. Schulz
Engineering Fundamentals, Sheryl A. Sorby
Geological and Mining Engineering and Sciences, Wayne D. Pennington
Materials Science and Engineering, Mark R. Plichta
Mechanical Engineering-Engineering Mechanics, William W. Predebon

College of Sciences and Arts
Dean, Maximilian J. Seel

Department Chairs
Aerospace Studies, Terrence L. Sunnarborg
Army ROTC, Patrick J. Slowey
Biological Sciences, John H. Adler
Chemistry, Sarah A. Green
Computer Science, Linda M. Ott
Education, Bradley H. Baltensperger
Fine Arts, Milton L. Olsson
Humanities, Robert R. Johnson
Mathematical Sciences, Alphonse H. Baartmans
Exercise Science, Health and Physical Education, Jason R. Carter
Physics, Ravindra Pandey
Social Sciences, Bruce E. Seely

School of Business and Economics
Dean, Christa L. Walck
Associate Dean, James O. Frendewey

School of Forest Resources and Environmental Science
Dean, Margaret R. Gale

School of Technology
Dean, Scott J. Amos

Graduate School
Dean, Jacqueline E. Huntoon

J. R. Van Pelt Library
Director, Phyllis H. Johnson

University Accreditation
Michigan Technological University is accredited by: North Central Association of Colleges and Schools, the Higher Learning Commission. Accreditation documentation may be reviewed in the Office of the Provost and Vice President for Academic Affairs.

North Central Association of Colleges and Schools, the Higher Learning Commission
30 North LaSalle St, Suite 2400
Chicago, IL 60602-2504
312-263-0456 and 800-621-7440; 312-263-7462 (fax)
www.ncahigherlearningcommission.org.
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:

- biomedical engineering
- chemical engineering
- civil engineering
- computer engineering
- electrical engineering
- engineering (interdisciplinary or special focus)
- environmental engineering
- geological engineering
- materials science and engineering
- mechanical engineering

**School of Technology**
The Technology Accreditation Commission of ABET accredits the following engineering technology programs:

- BS in electrical engineering technology
- BS in mechanical engineering technology

**ABET address**
Accreditation Board for Engineering and Technology, Inc.,
111 Market Place, Suite 1050
Baltimore, MD 21202
410-347-7700; 410-625-2238 (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—AACSB International**
The BSBA degree program of the School of Business and Economics is accredited by AACSB International -The Association to Advance Collegiate Schools of Business, the premier business accrediting organization in the US. Only about 400 US business programs (of 1,200 nationwide) have earned this distinction.

AACSB International
600 Emerson Road, Suite 300
St. Louis, MO. 63141-6762 USA
314-872-8481; 314-872-8495 (fax)

**School of Forest Resources and Environmental Science**
The Society of American Foresters accredits the forestry program.

Society of American Foresters
6400 Grosvenor Lane
Bethesda, MD 20814-2198
301-897-8720; 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 Society of Composers
- Broadcast of Music
- Hispanic Association of Colleges and Universities (HACU)
- Keweenaw Peninsula Chamber of Commerce
- Keweenaw Industrial Council
- National Action Council for Minority Engineers, Inc. (NACME)
- National Association of Minority Engineering Program Administrators (NAMEPA)
- National Association of College and University Business Officers
- National Association of State Universities and Land Grant Colleges
- North Central Association of Colleges and Schools (NCA), The Higher Learning Commission
- Operation Action UP
- President’s Council, State Universities of Michigan
- Science Coalition
- SESAC Inc.
- Women in Engineering Programs Advocate Network (WEPAN)