# 2013-14 Academic Calendar

## Fall Semester

<table>
<thead>
<tr>
<th>Week 1</th>
<th>September 2, Monday</th>
<th>Labor Day recess, 1 day only</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>September 3, Tuesday</td>
<td>Instruction begins</td>
</tr>
<tr>
<td></td>
<td>September 6, Friday noon</td>
<td>K-Day recess</td>
</tr>
<tr>
<td>Week 2</td>
<td>September 9, Monday</td>
<td>Classes resume</td>
</tr>
<tr>
<td>Week 12</td>
<td>November 22, Friday 10:00 pm</td>
<td>Thanksgiving recess begins</td>
</tr>
<tr>
<td>Week 13</td>
<td>December 2, Monday</td>
<td>Classes resume</td>
</tr>
<tr>
<td>Week 14</td>
<td>December 13, Friday</td>
<td>Last day of regular classes</td>
</tr>
<tr>
<td></td>
<td>December 14, Saturday</td>
<td>Mid-year commencement</td>
</tr>
<tr>
<td></td>
<td>December 16, Monday – December 20, Friday</td>
<td>Final exam period</td>
</tr>
<tr>
<td></td>
<td>December 20, Friday</td>
<td>Fall semester ends</td>
</tr>
</tbody>
</table>

## Spring Semester

<table>
<thead>
<tr>
<th>Week 1</th>
<th>January 13, Monday</th>
<th>Instruction begins</th>
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<tbody>
<tr>
<td>Week 2</td>
<td>January 20, Monday</td>
<td>Martin Luther King Day recess, 1 day only</td>
</tr>
<tr>
<td></td>
<td>January 21, Tuesday</td>
<td>Classes resume</td>
</tr>
<tr>
<td>Week 4</td>
<td>February 5, Wednesday 10:00 pm</td>
<td>Winter Carnival recess begins</td>
</tr>
<tr>
<td>Week 5</td>
<td>February 10, Monday</td>
<td>Classes resume</td>
</tr>
<tr>
<td>Week 8</td>
<td>March 7, Friday 10:00 pm</td>
<td>Spring Break begins</td>
</tr>
<tr>
<td>Week 9</td>
<td>March 17, Monday</td>
<td>Classes resume</td>
</tr>
<tr>
<td>Week 14</td>
<td>April 25, Friday</td>
<td>Last day of regular classes</td>
</tr>
<tr>
<td></td>
<td>April 28, Monday – May 2, Friday</td>
<td>Final Exam period</td>
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<tr>
<td></td>
<td>May 2, Friday</td>
<td>Spring Semester ends</td>
</tr>
<tr>
<td></td>
<td>May 3, Saturday</td>
<td>Commencement</td>
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</table>

## Summer Semester

<table>
<thead>
<tr>
<th>Week 1</th>
<th>May 12, Monday</th>
<th>Full session begins</th>
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<tbody>
<tr>
<td></td>
<td>May 12, Monday</td>
<td>Session A begins</td>
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<tr>
<td>Week 3</td>
<td>May 26, Monday</td>
<td>Memorial Day recess, 1 day only</td>
</tr>
<tr>
<td>Week 7</td>
<td>June 26, Thursday</td>
<td>Session A ends</td>
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<tr>
<td></td>
<td>June 27, Friday</td>
<td>Session A exam period</td>
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<tr>
<td>Week 8</td>
<td>June 30, Monday</td>
<td>Session B begins</td>
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<tr>
<td></td>
<td>July 4, Friday</td>
<td>Independence Day recess, 1 day only</td>
</tr>
<tr>
<td>Week 14</td>
<td>August 14, Thursday</td>
<td>Session B ends</td>
</tr>
<tr>
<td></td>
<td>August 14, Thursday</td>
<td>Full Session ends</td>
</tr>
<tr>
<td></td>
<td>August 15, Friday</td>
<td>Full Session, Session B exam period</td>
</tr>
</tbody>
</table>
Dear Students:

Welcome to a campus designed with you in mind. Michigan Tech is dedicated to providing exactly the kind of hands-on, practical education you need as you prepare to create your own future and a better future for Michigan, the nation, and the world.

Academically, we are responding to students' changing educational interests and needs by adding new degrees, minors, certificate programs, and courses. Recent examples:

- Bachelor of Science in Management with Concentration in Supply Chain & Operations Management
- Minor in Global Business
- Certificate in Business Analytics
- Certificate Chinese language and Area Study

At Michigan Tech, learning is not limited to campus classrooms. The University's D80 program provides a variety of exciting opportunities for study and service in other countries. And the Enterprise program offers hands-on experience working with industry to solve real-world problems. Our Peace Corps Masters International program is the largest in the United States.

Your physical surroundings—the classrooms, labs and study areas, residences and recreational facilities—also play a huge role in your college experience.

- The Great Lakes Research Center was dedicated in August 2012; this Center will make Michigan Tech the hub of interdisciplinary research and education focused on understanding and preserving one of the largest fresh-water supplies on earth

Another benefit of attending Tech is the opportunity to participate in the variety of activities that make a Michigan Tech education unique. One low Experience Tech fee covers your attendance at athletic events, arts, and entertainment on campus, use of recreational facilities at the Student Development Complex, and outdoor activities such as downhill and cross-country skiing and golf.

I encourage you to take a tour of Michigan Tech, to see our facilities and meet our outstanding faculty members, whose first concern is helping you get a first-class education.

I wish you well!

Glenn D. Mroz, Ph.D., President
Academic Programs (Undergraduate)
Baccalaureate Degrees (BA, BS)
Certificates
Majors
Minors

Colleges and Schools

College of Engineering
  Biomedical Engineering
  Chemical Engineering
  Civil and Environmental Engineering
  Electrical and Computer Engineering
  Engineering Fundamentals
  Geological and Mining Engineering and Sciences
  Materials Science and Engineering
  Mechanical Engineering-Engineering Mechanics

College of Sciences and Arts
  Aerospace Studies (Air Force ROTC)
  Biological Sciences
  Chemistry
  Cognitive and Learning Sciences
  Computer Science
  Kinesiology and Integrative Physiology
  Humanities
  Mathematical Sciences
  Military Science (Army ROTC)
  Physics
  Social Sciences
  Visual and Performing Arts

School of Business and Economics
  Accounting
  Economics
  Finance
  Information Systems
  Management
  Marketing
  Operations and Systems Management

School of Forest Resources and Environmental Science
  Applied Ecology and Environmental Science
  Forestry
  Wildlife Ecology and Management

School of Technology
  Computer Network and System Administration
  Construction Management
  Electrical Engineering Technology
  Industrial Technology
  Mechanical Engineering Technology
  Survey Engineering
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Student Resources

General Education

Course Descriptions

Appendices
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B: Standards of Progress
C: University Information—Assessment, Leadership, Accreditation
D: Campus Map

Catalog Acknowledgments

Office of the Provost and Vice President for Academic Affairs
University Marketing and Communications
The material presented in this catalog is subject to change by the University at any time.

In keeping with its responsibilities as an educational institution, Michigan Technological University is committed to a policy of affording equal opportunity to all of its employees, students, applicants for employment, and applicants for admission without regard to race, religion, color, national origin, age, sex, sexual orientation, height, weight, or marital status. The University is also committed to a policy of educating and employing handicapped individuals and veterans without discrimination. These policies are to be implemented with due regard for the relative qualifications of all involved. The Affirmative Action Officer is Sherry L. Kauppi, 207 Administration Building, Michigan Technological University, 1400 Townsend Drive, Houghton, MI 49931-1295. Telephone 906-487-3310.

MTU complies with all federal and state laws and regulations regarding discrimination, including the Americans with Disabilities Act of 1990 (ADA).
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 preceded the California Gold Rush by several years.

The college was originally established to train mining and metallurgical engineers. Today, the University offers certificate programs and associate, bachelor, master, and doctoral degree programs in engineering; forest resources; computing; technology; business; economics; natural, physical, and environmental sciences; arts; humanities; and social sciences.

Michigan Tech undergraduates benefit from an education that emphasizes research, cross-disciplinary study, and team learning. Our graduate students receive intensive, advanced instruction and the opportunity to pursue research in a wide range of academic programs. Our institution has gained worldwide attention for innovative education and ground-breaking research; our faculty members act as mentors; our academic programs stress hands-on learning; 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 the Keweenaw Waterway, a long, winding ribbon of water that divides the peninsula. Just a few miles from campus, on either end of the waterway, lies Lake Superior, the largest freshwater lake in the world by surface area.

Upper Michigan's expansive waters and forests offer students unparalleled opportunities for outdoor recreation, such as hiking, biking, camping, boating, swimming, snowshoeing, and skiing. The University owns an eighteen-hole golf course, an Alpine ski hill, and cross-country ski trails. It also has an array of men's and women's athletic programs, including Division I ice hockey and our newest addition, women's soccer.

Houghton is part of the Houghton-Hancock twin-city center of approximately 12,000 residents. The University's more than 7,000 students from many states and nations make the area a vibrant, multicultural community. Houghton is home to many exciting cultural activities, including the annual fall Parade of Nations, a celebration of the community's diversity.
Campus Contacts
All numbers are preceded by area code (906).

Essential Student Services
Admissions (mtu4u@mtu.edu) ........................................... 487-2335
Graduate Admissions .................................................. 487-2327
Transfer Admissions ................................................... 487-2335
Counseling Services ................................................... 487-2538
Financial Aid Office ................................................... 487-2622
Housing and Residential Life ........................................ 487-2682
International Programs and Services ......................... 487-2160
Student Service Center ............................................. 487-2319
Student Billing/Cashier’s Office ................................. 487-2393/487-2247
Registrar’s Office ..................................................... 487-2319
Information Technology ............................................ 487-1111

Colleges, Schools, Departments
College of Engineering ............................................. 487-2005
Biomedical Engineering ............................................ 487-2772
Chemical Engineering .............................................. 487-3132
Civil and Environmental Engineering .......................... 487-2520
Electrical and Computer Engineering ......................... 487-2550
Engineering Fundamentals ....................................... 487-3057
Geological and Mining Engineering and Sciences ........ 487-2531
Materials Science and Engineering ............................ 487-2630

College of Sciences and Arts ....................................... 487-2156
Aerospace Studies (Air Force ROTC) ......................... 487-2652
Biological Sciences .................................................. 487-2025
Chemistry ............................................................... 487-2048
Cognitive and Learning Sciences ................................ 487-2460
Computer Science ................................................... 487-2209
Kinesiology and Integrative Physiology ....................... 487-2715
Humanities ........................................................... 487-2540
Mathematical Sciences ............................................. 487-2068
Military Science (Army ROTC) .................................. 487-2650
Physics ................................................................. 487-2086
Social Sciences ........................................................ 487-2113
Visual and Performing Arts ....................................... 487-2067

Schools of
Business and Economics ........................................... 487-2668
Forest Resources and Environmental Science ............. 487-2454
Technology ........................................................... 487-2259

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

Michigan Tech Switchboard
906-487-1885

Emergency
Call 911
Public Safety and Police Services 487-2216

Mailing Address
(Name or department)
Michigan Technological University
1400 Townsend Drive
Houghton, MI 49931-1295

University Offices
All numbers are preceded by area code (906).

Student Billing/Cashier’s Office ................................. 487-2393/487-2247
Dean of Students ...................................................... 487-2212
Diversity and Inclusion, Center for ............................. 487-2920
Enrollment, Marketing and Communications ............... 487-1832
Graduate School ..................................................... 487-2327
Health Services ....................................................... 483-1860
Housing and Residential Life ..................................... 487-2682
Housing Facilities ................................................... 487-2740
Identification Cards (Information Technology) ............ 487-1111
Information Technology ........................................... 487-1111
International Programs and Services ......................... 487-2160
Intramural-Recreational Sports .................................. 487-2929

Library - Director's Office, J. R. Van Pelt/Opie .............. 487-2500
Archives .................................................................... 487-2505
Borrowing and Lending ............................................. 487-2508
Digital Studio .......................................................... 487-2508
Interlibrary Loan ...................................................... 487-3207
Research Help ......................................................... 487-2507
Lode (Student Newspaper) ........................................ 487-2404
Mail Services ........................................................... 487-2348
Memorial Union, Director .......................................... 487-2543
Museum, Seaman Mineral .......................................... 487-2572
Ombuds ..................................................................... 487-2406
Parking Permits (Transportation Services) ................... 487-1441
President's Office ....................................................... 487-2200
Provost's Office ......................................................... 487-2440
Public Safety and Police Services ............................... 487-2216
Registrar's Office ...................................................... 487-2319
Research, Vice President .......................................... 487-3043
Scheduling/Registration ............................................. 487-2319
Sports and Recreation ................................................ 487-2975
Student Activities ..................................................... 487-1963
Student Affairs ........................................................ 487-2465
Student Development Complex ................................ 487-2578
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Student Life .............................................................. 487-2687
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Veterans’ Affairs ..................................................... 487-2319
Academic Programs

The requirements for all associate and baccalaureate degree programs, as well as for certificates and minors, are listed below for the 2013-14 academic year, along with a directory of Colleges and Schools.

- Baccalaureate Degree Programs
- Certificate Programs
- Minors
- Colleges and Schools Contact Information

For the most up-to-date requirements, see your academic advisor or department. You may also select a degree audit by using the Undergraduate Degree Audit Search.

For more information on academic opportunities available to Michigan Tech students, click on the links below.

- Double Majors
- Additional Degrees
- Accelerated Master's Degree
- Study Abroad
- Cooperative Education (Co-op)
- English as a Second Language Programs
- MICUP/MI-LSAMP Transfer Transition Program
- Secondary Teacher Certification

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 every effort will be made to give the student the benefit of the new educational program without imposing undue hardship.
Baccalaureate Degrees

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

**Business and Economics, School of Engineering, College of**

Forest Resources and Environmental Science, School of Sciences and Arts, College of Technology, School of

Some degrees also specify requirements for particular concentrations. Students interested in obtaining a minor, certificate, double major, or an additional degree should consult with their academic advisors.

### School of Business and Economics
- Accounting (BACC)
- Economics (BEC)
- Economics—Secondary Education (BEC2)
- Engineering Management (BEM)
- Finance (BFIN)
- Management (BMGT)
- Management Information Systems (BMIS)
- Management—Supply Chain & Operations Management (BMG1)
- Marketing (BMKT)

### School of Forest Resources and Environmental Science
- Applied Ecology & Environmental Sciences (FES)
- Forestry (FFR)
- Wildlife Ecology and Management (FWEM)

### School of Technology
- Computer Network and System Administration (TCSA)
- Construction Management (TCMG)
- Electrical Engineering Technology (TEET)
- Engineering Technology (AAS) (TAET)
- Mechanical Engineering Technology (TMET)
- Surveying Engineering (TSE)

### College of Sciences and Arts
- Anthropology (SANT)
- Applied Physics (SAP)
- Audio Production and Technology (SFAT)
- Biochemistry and Molecular Biology—Biological Sciences (SMBB)
- Biochemistry and Molecular Biology—Chemistry (SMBC)
- Bioinformatics (SBI)
- Biology—General Biology (SBL1)
- Biology—Preprofessional (SBL5)
- Biology—Secondary Ed (SBL7)
- Cheminformatics (SCHI)
- Chemistry—ACS Certified (SCH)
- Chemistry—Biochemistry (SCH2)
- Chemistry—Chemical Physics (SCH4)
- Chemistry—Environmental (SCH5)
- Chemistry—Polymers (SCH1)
- Chemistry—Secondary Ed (SCH3)
- Communication, Culture and Media—Contemporary Culture (SCH4)
- Communication, Culture and Media—Language & Diversity (SCH5)
- Communication, Culture and Media—Media (SCH6)
- Computer Science—Applications (SCS1)
- Computer Science—Computer Networks & Systems Administration (SCS1)
- Computer Science—Industrial Computer Systems Administration (SCS4)
- Computer Science—software Engineering (SCS2)
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<td>Computer Science—Information Systems (SCS3)</td>
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<td>Mathematics—Actuarial Science (SMA6)</td>
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<td>Software Engineering (SSEN)</td>
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<td>Theatre and Electronic Media Performance (SEMP)</td>
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<td>Theatre and Entertainment Technology, Bachelor of Science (SFET)</td>
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<td>Sports and Fitness Management (SSFN)</td>
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<td>Theatre and Entertainment Technology, Bachelor of Science (SFET)</td>
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</tbody>
</table>
A certificate is awarded upon completion of a body of courses providing students with knowledge of a disciplinary or interdisciplinary subfield. Certificates are noted on official transcripts and allow departments to offer curricular options not offered as a minor or a concentration within a major.

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.

The following certificates are available:

**School of Business and Economics and the School of Forest Resources and Environmental Science**
- Certificate in Business Analytics (CBA)
- Certificate in Industrial Forestry (CIF)
- Certificate in Geographic Information Systems (CGIS)

**College of Engineering**
- Certificate in Electric Power Engineering (CEPE)
- Certificate in Int'l Sustainable Development Engineering (CISE)
- Certificate in Hybrid Electric Drive Vehicle Engineering (CHEV)

**College of Sciences and Arts**
- Certificate in Actuarial Science (CASC)
- Certificate in Media (CMD)
- Certificate in Modern Language (CCH, CFR, CGE, CSP)
- Certificate in Writing (CWR)
- Certificate in Coaching Endorsement (CCE)
- Certificate in Teaching English to Speakers of Other Languages (CTES)

**Interdisciplinary Certificates**
- Certificate in Global Technological Leadership (CGTL)
The purpose of a minor is to officially recognize a student who takes a prescribed set of courses in a discipline outside their major. To receive a minor, students must be currently enrolled in a bachelor's degree program at Michigan Tech, have indicated that they are pursuing the minor by submitting a Curriculum Add/Drop form, and have completed all requirements for the minor. The award will be noted on the official transcript.

A student must add the minor to their record no later than the time when the student submits their application for graduation. A student cannot be awarded a minor that has the same title as their major or major concentration. Students who wish to pursue a certificate in the same academic discipline or subject area as a minor must receive permission from the academic department.

In addition to meeting the requirements specified by the academic unit offering the minor, a student must:

- Maintain a minimum cumulative grade point average of 2.0 for courses completed as part of the minor.
- Take at least 6 credit hours of 3000-level or higher minor-required courses that are not required as part of their major (except as free electives). If more than one minor is being pursued, the 6 credit hours of 3000-level or higher minor-required courses that are not required as part of their major (except as free electives) must be unique to each minor.
- At least 6 credits of the 3000-level or higher minor-required courses must be taken at Michigan Tech. Courses that meet the "at Michigan Tech" requirement are defined as courses listed in the course catalog and taught by a Michigan Tech instructor either on campus, at field locations, or through distance learning.

Notes:
- All minors, including interdisciplinary minors, must originate in an academic department.
- Minors must require at least 16 credit hours of course work.
- Of these 16 credit hours, no more than 6 credit hours may be at the 1000- or 2000-level.
- For minors exceeding 16 credit hours, the additional credit hours beyond 16 may be at any level.
- Tracks, or focus areas, are not allowed in minors with the exception of the four minors with tracks that currently exist (Biological Sciences, Music, Polymer Science and Engineering, and Bioprocess Engineering).
Minors

School of Business and Economics
- Economics (BECM)
- Global Business (BGBM)

College of Engineering
- Aerospace Engineering (EMAE)
- Applied Geophysics (EAGM)
- Earth Sciences (EGLM)
- Electrical Engineering (EEEM)
- Electronic Materials (MSEM)
- Enterprise (ENTM)
- Geological Engineering (EGEM)
- Manufacturing (EMMF)
- Mineral Processing (CMMP)
- Mining (EMGM)
- Municipal Engineering (ECEM)
- Polymer Science and Engineering (ECMM)
- Structural Materials (MSSM)

School of Technology
- Data Acquisition and Industrial Control (TDAC)

Interdisciplinary Minors
- Alternative Energy Technology (IMAE)
- Bioprocess Engineering (IMBE)
- Ecology (IMEC)
- Nanoscale Science and Engineering (Nanotechnology) (IMNT)
- Plant Biotechnology (IMPB)
- Plant Sciences (IMPS)
- Remote Sensing (IMRS)

College of Sciences and Arts
- Aerospace Studies (AFAS)
- American Studies (SSAS)
- Art (FAAR)
- Astrophysics (SPHA)
- Biochemistry (BLBC)
- Biological Sciences (SBLM)
- Chemistry (SCHM)
- Coaching Fundamentals (PECF)
- Communication Studies (HUCS)
- Computer Science (SCSM)
- Diversity Studies (HUSD)
- Environmental Studies (SSES)
- Ethics and Philosophy (HUEP)
- Fish Biology (BLFB)
- French (HUF)
- French International (HUIF)
- German (HUG)
- German International (HUIG)
- Historical Studies (SSHS)
- International Studies (SSIS)
- Journalism (HUJN)
- Law and Society (SSLS)
- Mathematical Sciences (SMAM)
- Microbiology (BLMB)
- Military Arts and Science (AMAS)
- Music (FAMU)
- Music Composition (FAMC)
- Pharmaceutical Chemistry (CHPM)
- Physics (SPHM)
- Psychology (PSYM)
- Social and Behavioral Studies (SSBH)
- Spanish (HUS)
- Spanish International (HUIS)
- Technical Theatre (FATT)
- Theatre Arts (FATA)
The University

Double Majors

A double major is a Michigan Tech bachelor's degree with two majors and 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, "Bachelor of Science in Mechanical Engineering with an additional major in Mathematics".

- The double major is distinctly different from the second degree. Majoring in two subjects 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 majors have very different requirements necessitating the completion of 32 or more "additional" credits, students should consider a second degree program that results in the awarding of two distinct baccalaureate degrees and diplomas.
- A student pursuing a double major will designate one as the primary major. Students planning to earn a double major should declare both majors and begin planning their course work as early as possible. Advisors must be identified in the departments of both majors in order to assure that the degree requirements of both are met.
- Students may only earn an additional major if that major is offered under the same degree type (Bachelor of Science or Bachelor of Arts) as the primary major. If the degree types for the majors are different then the student must pursue a second degree.
- If a single department offers two distinct majors, it is possible to complete a double major within that department by fulfilling the requirements for both majors. However, student may not earn a double concentration or option within a single major.
- 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 beginning the senior project.
- Students who have previously been awarded a degree cannot have the double major designation added to their transcript.

Students desiring a double major should indicate their intent by filing a Curriculum Add/Drop form (available in the department advising office) complete with signature from the academic advisor for the additional department with the Registrar's Office.

Additional Baccalaureate Degrees

A student enrolled at Michigan Technological University who is currently pursuing (or already has) a Baccalaureate degree or degrees can obtain an additional Baccalaureate degree from Michigan Tech. Unlike a double major, an additional Baccalaureate degree (or degrees) will grant the student an entirely separate diploma. Students must initiate the process for obtaining an additional degree by completing a degree audit with their additional degree advisor. Students pursuing a Baccalaureate degree from Michigan Tech can earn an additional degree at the same time if they meet the following requirements:

- Satisfy the degree requirements for each Baccalaureate program.
- Earn at least 32 of the credit hours required for the additional degree through Michigan Tech without having applied those credits to any other minor or Baccalaureate degree program. The academic unit offering the additional degree can allow course substitutions provided that the 32 credit hour minimum is maintained.

An enrolled student who has already earned a Baccalaureate degree (from Michigan Tech or a college or university accepted by Michigan Tech) can obtain a Baccalaureate degree or degrees from Michigan Tech if they:

- Complete an Additional Baccalaureate Degree Completion Form with their advisor.
- Satisfy the degree requirements for the additional Baccalaureate program.
- Earn at least 32 of the credit hours required for each additional degree through Michigan Tech without having applied those credits to any other minor or Baccalaureate degree program. The academic unit offering the additional degree can allow course substitutions provided that the 32 credit hour minimum is maintained.

A student who plans to pursue an additional baccalaureate degree must also submit a Curriculum Add/Drop form, complete with signature from the academic advisor in the degree-granting department, to the Registrar's Office.
Accelerated Master’s Degree

Undergraduate students may pursue a master’s degree in conjunction with their baccalaureate degree by applying a limited number of credits toward both the master’s and bachelor’s degrees using the following student guidelines:

- Only students who intend to complete both their bachelor's and master's degrees at Michigan Tech can enroll in an accelerated master’s program.
- Students already enrolled in a graduate program may not retroactively use this policy.
- In order to be formally accepted into an accelerated master's program students must apply to and be accepted into the Graduate School at Michigan Tech. Applications will be reviewed by departments and programs according to their normal procedure.
- Students can apply for admission to an accelerated master’s program at any time after they attain sophomore-level class standing and up until they are awarded their bachelor’s degree.
- Only students with a cumulative GPA of 3.0 or above are eligible to enter an accelerated master’s program. Programs may set higher admission requirements. For example, programs may require a cumulative GPA of 3.5 for admission to a research-based (thesis or report option) master’s program.
- Students who are accepted to the program will not be allowed to continue if their cumulative undergraduate GPA falls below 3.0. A higher GPA may be required by the program.
- Students must consult with their academic advisor and the graduate school regarding restrictions on the use of coursework and research credits under the accelerated master’s degree policy prior to enrollment in any courses intended to be used toward the master’s degree.
- Students will be considered undergraduates for the purposes of financial aid, tuition, and class standing until their undergraduate degree has been awarded. Once students are awarded their undergraduate degree, they will be considered graduate students for the purposes of financial aid and tuition.
- Students who are accepted into an accelerated master's degree program may also take courses under the senior rule policy.
- Additional information for academic departments may be found in the accelerated master’s University Senate degree policy.

The Michigan Tech Graduate School maintains a list of programs that are currently available as an accelerated program.

International Programs and Services—Study Abroad

What better way to create the future than to study abroad? The International Programs and Services Office provides students with high-quality international academic opportunities in more than thirty nations around the world. Every year, hundreds of students choose to study abroad for a summer, semester, or year at a foreign university. Students will earn credit toward their degree or minor, and spend a once-in-a-lifetime opportunity developing skills needed to become productive and successful members of the global community.

Study abroad programs at Michigan Tech are very affordable because tuition will be at least the same as your Michigan Resident or Non-Michigan Resident tuition rate. Financial aid and scholarships usually apply to semester and year-long programs. The Office of International Programs and Services is an excellent resource for available scholarships and grants.

Students from every discipline choose study abroad, especially considering that many courses abroad are taught in English. While knowledge of a foreign language is not necessary for many programs, living abroad is an excellent way to improve language skills.

Cooperative Education (Co-op)

Michigan Tech encourages undergraduate and graduate students to participate in cooperative education, an experience which is essentially one of the most important qualifications sought by employers. The goal of the Cooperative Education Program at Michigan Tech is to provide practical work experience prior to graduation. As a joint venture between the student, the University, and an employer, work assignments are related to the student's major field of study and are varied to provide a range of training and experience.
The degree of complexity of work assignments are intended to match the level of the student's training, progressing with each work assignment. Since the co-op student must complete the same academic program as a non-co-op student, the co-op student typically defers graduation by as much as a full calendar year.

To qualify for the co-op program as an undergraduate, a student must have completed all first-year course work. Transfer students must complete at least one semester in residence at Michigan Tech. Undergraduate students in the co-op program are expected to maintain a grade point average of 2.20 or better and be in good academic and social standing with the University. Each semester of undergraduate co-op carries 1 or 2 academic credits, which may be applied toward an academic degree, depending on the degree-granting department. Graduate students are required to maintain at least a 3.0 GPA. Additionally, they must obtain permission from their advisor and have full-time student status while applying for and participating in the co-op assignment. Graduate students may earn from 1 to 6 credits per co-op semester.

Co-op program options are designed to accommodate the needs of both the student and the employer. Co-op assignments may range from one semester to a full year or rotate between school and work sessions.

Michigan Tech has entered into a cooperative education relationship with more than 2,000 companies and organizations in the United States and abroad. Although a majority of students choose to co-op in the Midwest, students have been placed across the nation and internationally. For more information, visit the Career Services’ co-op website.

**English as a Second Language Program**

The Intensive English as a Second Language (IESL) Program provides instruction in English language and American culture for international students interested in pursuing a degree at Michigan Tech.

IESL classes follow Michigan Tech's academic calendar and are offered during fall, spring, and summer semesters. IESL courses include all language skills: reading/vocabulary, writing, grammar, and listening/speaking at the intermediate, advanced and transitional levels.

The SMILE Program, Summer Intensive Language Experience, is a program offered from July to August.

For more information, contact the IESL Program at iesl@mtu.edu or call 906-487-2540.

**MICUP/MI-LSAMP Transfer Transition Program**

The Michigan College University Partnership (MICUP) Transfer Transition Program, partnered with the Michigan Louis Stokes Alliances for Minority Participation (MI-LSAMP), focuses on the recruitment and support of underrepresented and economically disadvantaged community college students to academic programs at Michigan Tech. Our current community college partners are Delta College, Grand Rapids Community College, and the Wayne County Community College District.

The program includes a seven-week summer university and residential experience, undergraduate research with a faculty member, and the opportunity to enroll in a 3-credit Michigan Tech course. If selected to attend, these and other opportunities are provided at no cost to students. A competitive stipend is granted to each participant.

For more information, contact the Center for Diversity and Inclusion at 906-487-2920 or visit our webpage.

**Secondary Teacher Certification**

Specific major programs grant both secondary school teacher certification and a bachelor’s degree in the following certification areas. You must apply to the Department of Cognitive and Learning Sciences for admission to these programs.

- Biology (BS in Biological Sciences or Medical Laboratory Science, BS in Wildlife Ecology, Applied Ecology, or Forestry)
- Chemistry (BS in Chemistry)
- Computer Science (BS in Computer Science)
- Earth Science (BS in Geology)
- Economics (BS in Economics)
- English (BA in English)
- Integrated Science (BS in Engineering or Sciences)
- Mathematics (BS in Mathematics)
- Physics (BS or BA in Physics)
- Social Studies (BS in Social Sciences)

**Officers’ Training (ROTC)**

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. Those students holding ROTC scholarships become obligated to their respective service at the beginning of their sophomore year. Students completing the Army program may receive a commission as an officer in the Army. Students completing the Air Force program will receive a commission as an officer in the Air Force.

**Preprofessional Programs**

Many different undergraduate majors and courses of study can lead to successful admission to professional schools after completion of a bachelor's degree. Admission requirements of 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 institution's professional programs. Students should consult with their advisors for courses of study.

Three departments on campus have specific programs for students pursuing professional careers in medicine and the related health sciences or in law. The prephysical therapy advisor, located in the Department of Kinesiology and Integrative Physiology assists students preparing for admission to physical therapy school. The premedical advisor, located in the Department of Biological Sciences, helps students preparing for admission to schools of medicine, dentistry, optometry, pharmacy, podiatry, veterinary medicine, and other health professions. The prelaw advisor, located in the Department of Social Sciences, works specifically with students interested in pursuing careers in law.
Admissions—Getting In

Application Procedure

General information regarding first-year students, transfer, international, and other types of undergraduate student admission:

1. Complete the Michigan Tech Application for Admission any time up to one year before you plan to enroll.
2. There is no fee to apply to Michigan Tech. Applicants should complete the free online application.
3. Prospective first-year students: ask your high school guidance office to send your official transcript, official ACT and/or SAT scores, and the optional high school counselor information page directly to the Michigan Tech Admissions Office or request to have your transcript sent to us through a service such as Docufide.
4. Prospective transfer students: submit application and official transcripts from all colleges attended to the Michigan Tech Admissions Office. Official high school transcripts are also required unless an associate degree or higher has been earned at time of application.
5. Prospective international students: see Admissions Procedures.

General Information

When To Apply—Admission to Michigan Tech is made on a space-available basis. Applicants are strongly encouraged to apply prior to January 15 for priority consideration. After this date, space limitations may affect application decisions.

All applications and supporting material must be received at least thirty days before the beginning of the semester of intended enrollment. Once students are accepted for admission, every effort is made by the faculty and staff to help them utilize the various resources offered by Michigan Tech.

The following documents must be received by the Michigan Tech Admissions office for an applicant to be considered for undergraduate admission (for information on graduate admissions, refer to the Graduate School).

• Application Forms—Applications may be completed online.
• Additional Materials—Materials to accompany the application include the official high school transcript(s) and the optional high school counselor information page. Transfer students must submit official transcripts from all colleges attended as well as an official high school transcript showing the date of graduation. Official high school transcripts are also required unless an associate degree or higher has been earned at time of application.
• Test Scores—Scores from the ACT or the SAT college admission examinations are evaluated 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 ACT is 2030; for the SAT it is 1464. Test registration forms are available at high school counseling offices or from the testing agencies.
  o SAT
  o ACT

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

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

First-Year Students

Application Procedure

1. Complete the free online application.
2. Request to have your transcript sent to us through a service such as Docufide or ask your high school guidance office to send the following documents directly to the Admissions Office:
   a. Official transcript (showing grades through your junior year)
   b. Official ACT and/or SAT scores
      i. If your test scores are not included on your official transcript, you may have them sent directly to Michigan Tech by providing the appropriate school code to the testing agency (ACT code is 2030; SAT code is 1464).
c. Optional high school counselor information page

3. Applicants will be notified of their admission status as soon as completed credentials are received and evaluated by the admissions staff—typically within two to three weeks.

High School Course Recommendations

Prospective students are encouraged to complete a rigorous high school curriculum. The following high school course recommendations apply to all academic programs at Michigan Tech, although some academic program qualifications may be higher or lower than those listed here. Contact the Michigan Tech Admissions Office with any questions.

- **Mathematics** — Three years recommended; four years strongly recommended
- **Natural Science** — Three years strongly recommended (including one year of biological sciences and one year of chemistry or physics)
- **English** — Three years recommended; four years strongly recommended (classes should cover literature, composition, standard language usage, essay/theme writing, writing a research paper, and one-half year of speech)
- **Social Studies** — Three years strongly recommended (including US and world history)
- **Computer Literacy** — One year strongly recommended
- **Foreign Language** — Two years recommended

*It is strongly recommended that students have a fourth year of college-prep mathematics, the core of which should be college algebra and analytic geometry, the elementary functions, limits, and similar precalculus topics. Other topics might include probability, statistics, permutations and combinations, mathematics induction, an introduction to the use of sets, and introduction to computers and computing, or an introduction to matrices and determinants. The emphasis should be placed on 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.

**Official High School Transcript**—must be submitted with all first-year applications in addition to all requirements listed under General Information (Application Forms, Additional Materials, and Test Scores).

Transfer Applicants for Admission

Students in good standing who have satisfactorily completed work at another college or university may apply for transfer admission.

Application Procedure

1. Complete the free online application.
2. Have all colleges attended submit official transcripts directly to the Admissions Office.
3. All students must submit an official copy of their high school transcript showing date of graduation unless an associate degree or higher has been earned at time of application. The transcript must be sent directly from the high school.

GPA Recommendations

An average of at least C+ (2.50 on a 4.00 scale) is generally recommended for students applying to Michigan Tech. 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 GPA at Michigan Tech.

Transfer credit

Transfer credit is granted in accordance with the guidelines established by the academic departments.

- **Specific or approved course credit** is granted for courses taken (including online courses) in which passing grades of C (2.00 on a 4.00 scale) or higher have been obtained, provided the courses are equivalent in content, length, and prerequisites to courses offered at Michigan Tech. Any online course presented for transfer credit must be acceptable for residence credit in a comparable program at the college or university offering the course.
- **Unassigned free-elective credit** may be granted for courses that are not comparable to those offered by Michigan Tech. Such credit will apply only toward the total credits required for graduation, unless the department of a student's
major authorizes the use of the credit to meet 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. The Michigan Tech Admissions Office can offer program-of-study suggestions to students who plan to transfer to Michigan Tech after completion of one or more years at a community college. Admissions advisors visit most Michigan and several out-of-state community colleges to provide special counseling and services.

Homeschooled Students
Michigan Tech welcomes homeschooled students to apply for undergraduate admission. A student may apply while final course work is still in progress.

Application Procedure
1. Complete the free online application.
2. Submit all required supporting materials:
   a. A high school transcript including a list of courses taken, grades received, or level of proficiency attained. This transcript can be from a homeschool curriculum agency or can be parent or instructor generated.
   b. Official ACT or SAT test scores sent directly to Michigan Tech from the testing agency. Paper copies of scores are not considered official and are therefore not acceptable.
   c. College transcripts, if any college-level course work has been taken. Transcripts must be sent directly from the college to be considered official.
   d. Official final high school transcript indicating date of graduation.

International Students
Admissions Criteria
International Graduate Students
Masters and Ph.D. students must apply for admission through the Graduate School. There is no application fee.

International First-Year, Exchange, Transfer and ESL Students
Apply online. There is no application fee, rolling admissions.

International Undergraduate Admissions Procedure
1. Complete the Michigan Tech Application for Admission any time up to one year before you plan to enroll. You may apply online or use our PDF admission application form. If you use the PDF form, it must be completed electronically, printed, and mailed to the IPS office.
2. Send all other required documents.
3. Satisfy US embassies' requirements for visa issuance, including certification of financial support.
4. Information, including a checklist and all necessary forms can be accessed at our website.

Academically eligible students who do not meet the English language proficiency requirements may be granted conditional admission by successfully completing our English as a Second Language program (ESL). If you score below the minimum required, you will automatically be considered for conditional admission. Applicants who are admitted to our English as a Second Language program may be eligible to enroll in University level courses with approval from the ESL advisor.

Preferred Application Deadlines
While there is no application deadline—applications are accepted on a rolling basis—we recommend that students follow the guidelines below:

Completed applications for admission for fall semester are due by April 1.
Completed applications for admission for spring semester are due by September 1.
Completed applications for SMILE: Summer Intensive Language Experience for students outside of the US are due by March 1.
Completed applications for SMILE: Summer Intensive Language Experience for students from Canada, Mexico, or those currently in the US are due by May 1.
Incomplete applications will be considered for admission the following semester.

**Admitted International Students**

An applicant is admitted to Michigan Tech only when he or she has submitted all application materials and meets all eligibility requirements. The applicant will be sent an official acceptance letter, scholarship notification (if appropriate), and the I-20 or DS2019 and other important documents by regular airmail unless rush delivery is requested (and paid for) by the student.

Based on the required orientation schedule and the schedule of the Housing Office and Dining Halls, IPS recommends that you plan to arrive in Houghton as close as possible to the check-in date. We would like you to read and use the Pre-Arrival Information to plan and prepare for your travel to and stay at Michigan Tech. Pay special attention to the instructions for submitting your arrival information. Upon arrival to Michigan Tech’s campus, accepted international students must report to the International Programs and Services (IPS) Office.

**Enrollment Deposit**

First-year and transfer students are required to pay a $100 Enrollment Deposit to secure course registration and housing assignments. So that we may properly plan for your arrival, we ask that you submit the deposit no later than 2 months before your intended term. Housing and course registration priority will be granted to students who submit the enrollment deposit.

**Other Applicants for Admission**

**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.

To apply for guest-student admission, submit a Michigan Uniform Undergraduate Guest Application form to the Michigan Tech Admissions Office. The form may be obtained from the Admissions Office or from any other college or university in Michigan.

**Nondegree Students**

**Application Procedure**

Complete the free [online application](#).

**Nondegree-seeking students** are not required to submit high school or college transcripts with their Application for Admission. However, if a nondegree-seeking student later desires to become degree seeking, 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 through the [dual enrollment program](#) with the permission of their high school.

**Acceptance**

**Notification**—Applicants will be notified of their admission status as soon as completed credentials are received and evaluated by the admissions staff—typically within two to three weeks.

**Acceptance Packet**—Upon acceptance to Michigan Tech, students receive information regarding the steps necessary to enroll as well as details about the enrollment deposit, course selection, housing and dining options, and orientation.
Former Students (Readmission)

Any University student whose enrollment is interrupted for one or more semesters must be readmitted to Michigan Tech through the Registrar's Office. Students may request readmission by letter, fax, or email and should include name, ID number, and semester for which readmission is requested, or by calling the Registrar's Office 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 in the Registrar's Office.

A student who has been suspended and requests to reenter the University must submit a written petition to the Dean of Students Office prior to the semester for which the student requests readmission. Please see the Dean of Students web page.
Finance 101

Basic Expenses

- Tuition Rates Past and Present
- Room and Board
- Michigan Tech Apartment Rates
- Payments

Applying for Financial Aid

University Merit-Based Awards
At Michigan Tech, we make it simple: your application for admission also serves as a scholarship application. Applicants accepted for admission prior to January 15 for the following academic year are automatically considered for merit-based University scholarships. The exception is the Michigan Tech Leading Scholars Award (see http://www.mtu.edu/finaid/types/scholarships/ for application requirements). Awards are based on eligibility criteria and an index that considers your academic record, including ACT or SAT scores, cumulative GPA, and class rank (if available).

Federal and State Aid
To apply for federal and Michigan financial aid, file a Free Application for Federal Student Aid (FAFSA) as soon as possible after January 1 and before March 1. File online at www.fafsa.gov. You'll need Michigan Tech's Federal School Code (002292) to complete your application. Please be prepared to provide any requested documents to the Financial Aid Office for verification purposes. We'll let you know what we need and when. Didn't file by March 1? You should still go ahead and file a FAFSA.

Financial Aid Package
Once you've completed your FAFSA and provided the requested information, we can prepare your financial aid package, which is the total amount of aid offered to you by Michigan Tech University. Your package will include need-based scholarships, grants, loans, and/or work-study opportunities for which you are eligible. Prospective students will receive their packages in mid-March. Current students will receive their awards in July. At that time, you may accept or decline any financial aid in your package.

Awarding Criteria for Financial Aid
First-Year Students—Recipients of first-year 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. Financial aid decisions for incoming students are announced in March and April for fall admission.

To enhance eligibility, applicants should take the American College Test (ACT), the College Entrance Examination Board Scholastic Aptitude Test (SAT), or the PSAT/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 students having completed two full-time semesters at any college or university. Recipients of new transfer awards are selected on the basis of college academic record. Students should apply to Michigan Tech by January 15 of the academic year preceding their intended term of enrollment.

Enrolled Students—Enrolled students who indicate their intention to return to Michigan Tech for the following academic year by registering for fall classes prior to the registration deadline are considered on a competitive basis for scholarships. Awards for enrolled, returning students are announced in July.
Scholarships/Grants

Michigan Tech offers scholarships sponsored by the University, individuals, companies, and by local, state, and federal agencies. The following list is not inclusive; for a complete list of scholarships and more information on application procedures, visit the Financial Aid website.

Michigan Tech Leading Scholar Awards—Michigan Tech's premier scholarship program is merit based and awarded to US domestic residents who are members of the current year's graduating high school class. Three Michigan-resident students will be awarded scholarships equivalent to regular full-time tuition, plus room and board, and a stipend of $1,000 each year. In addition, twenty-seven Michigan-resident students will receive $8,000 per year. Three out-of-state students will receive a value equivalent to regular full-time, out-of-state tuition. In addition, seven out-of-state students will receive $17,000 per year. Candidates must be recommended for the award by a high school teacher. Scholarship applications and teacher recommendation must be received by October 15. Leading Scholar applicants must also have applied to Michigan Tech University. The awards are renewable for four years (eight semesters). Recipients must maintain a minimum 3.25 cumulative grade point average to have the award renewed for the second, third, and fourth years. Recipients receiving an $8,000 or $17,000 scholarship must maintain a minimum cumulative GPA of 2.50 for renewal.

Presidential Scholars Program—These merit-based awards, which can be used for any baccalaureate curriculum, vary from $1,500 to $4,500 and support Michigan residents who are members of the current year's graduating class from Michigan high schools. Recipients must maintain a cumulative grade point average of 2.50 at the end of each spring semester. Continuous full-time undergraduate enrollment and acceptable social behavior must also be maintained. Students must live in the University's residence halls for their first and second academic years to maintain this scholarship. Students graduating from high schools within Houghton, Keweenaw, and Baraga counties (and have commuter status) are exempt.

Michigan Tech Transfer Scholarship—These merit-based awards, which can be used for any degree curriculum, support new incoming undergraduate transfer students who are Michigan residents and who have attended any college or university for a minimum of two semesters. The award values range from $1,500 to $3,000. Recipients must maintain a cumulative grade point average of 2.50 at the end of each spring semester. Continuous full-time undergraduate enrollment and acceptable social behavior must also be maintained.

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

International Ambassador Scholarships—These merit-based awards, which can be used for any degree curriculum, support citizens or residents of countries outside the United States. The value ranges from $1,500 to $6,000. Renewable for second, third, and fourth year students who maintain a cumulative grade point average of 2.50 as of the end of spring semester, acceptable social behavior, and continuous full-time undergraduate enrollment. Proof of community service and evidence of leadership are also required.

National Scholars Awards—These merit-based awards support non-Michigan residents of the US 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). First-year student awards range from $7,000 to $12,500. 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. Transfer-student award values range from $4,000 to $7,000. Scholarship recipients must maintain a cumulative grade point average of 2.50 at the end of each spring semester. Continuous full-time undergraduate enrollment and acceptable social behavior must also be maintained. Students must live in the University's residence halls for their first and second academic years to maintain this scholarship.

University Student Awards—This program is designed to provide financial assistance to incoming and current students at Michigan Tech. Awards are made based on academic potential and financial need. The amount of each award is variable, depending upon need. Michigan residents may be awarded up to the amount of full-time, in-state tuition. Students paying nonresident rates may be awarded an amount up to the difference between Michigan-resident tuition and nonresident tuition. Changes in expected family contribution (FAFSA results) and financial need may change the value of the University Student Award. This need-based award is available for a maximum of twelve semesters of undergraduate study. Recipients of this award must attend full-time, reapply each year, and meet the required minimum 2.00 cumulative GPA.
**ROTC Scholarships**—These include scholarships for both US Army and Air Force programs.

- The US Air Force offers two- to four-year scholarships for students who qualify for an Air Force commission. Scholarships typically cover partial tuition up to full tuition plus lab fees. Scholarship students also receive $900 per year for books. A $300 to $500 monthly tax-free allowance is provided to all contracted cadets. High school students must apply for the scholarship by December 1 of their senior year at www.afrotc.com. Interested college students with three or more years remaining to complete their degrees may be eligible for In-College or Express Scholarships and should stop by the ROTC building to learn more about these opportunities. Students should contact the [Air Force ROTC Department](#) at 906-487-2652 or [rotcinfo@mtu.edu](mailto:rotcinfo@mtu.edu).

- The US Army ROTC (Department of Military Science) offers its cadets scholarships that pay full tuition, fees, and $1,200 in books per year. Scholarships are offered to first- through third-year students and are available for up to a total of five years to allow for completion of degree requirements. Once contracted, cadets will additionally receive a $300 to $500 tax-free monthly stipend, depending on their year in school. High school students should apply online for a four-year Army ROTC scholarship before February of their senior year. Scholarships are also available for graduate students. Upon graduation and completion of all military training requirements, cadets will be commissioned as second lieutenants in the US Army, US Army Reserves, or Army National Guard. Students should contact the Army ROTC Department at 906-487-2650 or visit our [website](#).

**Other Aid Programs**

To be considered for these programs, students must submit the Free Application for Federal Student Aid (FAFSA).

**Federal Pell Grants**—This federal government program assists undergraduates. The amount of the grant depends on the cost of attendance, expected family contribution, enrollment status, and period of enrollment. Award values can change yearly. The current maximum is $5,645 for 2013-2014. A Pell Grant does not have to be repaid.

**Federal Supplemental Educational Opportunity Grants (FSEOG)**—These federal grants assist Pell Grant recipients with exceptional financial need. The award varies depending on the amount of funds available.

**Ray E. and Eleanor Cross 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 financial 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 $27,500. Interest does not accumulate until repayment period begins after graduation. Deferment of repayment is permitted for certain kinds of federal and volunteer service.

**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.

**PLUS Loans**—These federal loans are available to parents to help pay the educational costs of their dependent students enrolled at least half-time.

**Federal Work-Study Program**—This program, based on financial need, provides assistance through employment on campus. Every effort is made to place students in jobs related to their skills, interests, and fields of study. Work-study participants receive biweekly paychecks and are generally employed eight hours per week.

**Veterans Administration Education Benefits**—Various programs are available for veterans, reservists, and their dependents. Information and applications can be obtained from state veterans affairs offices or from the coordinator of veterans affairs at Michigan Tech.

**National Guard Programs**—Information about these programs can be obtained 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 Programs**—Need-based assistance 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 Financial Aid**—Undergraduates must be enrolled each semester in the number of billable credit hours listed below to receive the full value of their awards.

<table>
<thead>
<tr>
<th>Financial Aid</th>
<th>Credits</th>
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<td>Scholarships</td>
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<td>Full grant</td>
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<tr>
<td>University Student Award</td>
<td>12</td>
</tr>
</tbody>
</table>

* Students carrying 6–11 credits may receive a reduced Michigan Competitive Scholarship.


At Michigan Tech, in order to maintain consistency, a minimum requirement for financial aid has been established. However, there may be some types of aid, e.g., scholarships, with more stringent requirements; see Appendix B for details.
Academic Policies and Procedures

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 eight semesters, depending on their semester course load and degree requirements.

Class Standing—Determined by number of credit hours

- First-year students 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 by individual departments; 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 Dean of Students Office.

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 where students are officially representing the University scheduled on dates that are out of University control are exempted. For more information, please review Michigan Tech's policy on class attendance.

Absences—If possible, students should contact the instructor prior to the absence and arrange a mutually acceptable makeup 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 Dean of Students Office. Students having excused absences, as defined in the policy on class attendance, will be allowed to make up missing assignments or equivalent work.

Academic Integrity—Students who cheat, plagiarize, or fabricate data, as well as students who help others cheat, plagiarize, or fabricate, can receive sanctions of warning, probation, suspension or expulsion from the University, depending on the severity of the offense. See 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. Students should refer any questions concerning use of outside resources or collaboration on assignments to their instructor.

Weather Closure Policy—The president, provost and vice president for academic affairs, or their designated representative may decide to close the University 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
Academic Preparation

Advising
Upon enrollment, students are assigned academic advisors by their major departments. Students are urged to consult their advisors regularly for support in developing and achieving their academic and career goals. Students who have not declared a major should consult the "undeclared advisors" in General Sciences and Arts or Engineering Fundamentals.

Orientation
Orientation is an informative program designed to introduce new students to academic life, campus, and their classmates. For students entering in fall semester, attendance at the weeklong Orientation program is required for all new first-year students. Transfer students with more than 30 credits are required to attend a one-day orientation program. During orientation programs, students will learn about campus resources, university policies, and extracurricular activities. Students will meet with their academic advisor(s) to discuss departmental expectations and curriculum. Students will also have the opportunity to meet other students, become familiar with their new community, and to attend programs regarding the academic and social transitions to college life, specifically Michigan Tech. For students entering in spring and summer semesters, a condensed orientation is required.

Learning Centers
To support student success, Michigan Tech has learning centers offering peer and professional academic coaching through weekly appointments, team learning groups, and walk-in tutoring for the following areas: biological sciences, business and economics, chemistry, civil and environmental engineering, computer science, electrical and computer engineering, engineering fundamentals, forestry, mathematics, mechanical engineering, multiliteracies (writing), and physics.

ExSEL (Excelling the Student Experience of Learning)
ExSEL is designed to promote student success and encourage leadership development. The program offers academic support through services such as one-on-one meetings with staff, peer mentoring, grade monitoring, campus resource referrals, campus and community involvement opportunities, special events, and workshops. Additionally, participants enroll in the one-credit, graded UN1000, Frameworks for Success, course. This course provides an opportunity to learn about time management, study skills, working effectively in groups, civic leadership, utilizing campus resources, and other aspects of college life that contribute to student achievement. ExSEL also provides opportunities for students to participate in leadership positions as mentors, teaching assistants, and student employees.

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
The following are conditions of Good Academic Standing:

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, based on at least 16 credits.

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. Dean's List status is recorded on the students' transcripts and is also released to hometown newspapers and posted by the Dean of Students Office online.
University Honors List—Degree-seeking students who rank in the top 2% of his/her class in their school or college and have at least a 3.5 cumulative GPA while carrying 12 credits or more for fall and spring semesters, qualify for the University Honors List.

Graduation with Honors—Michigan Tech recognizes outstanding 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 (highest honors)
- 3.7–3.89 Magna Cum Laude (high honors)
- 3.5–3.69 Cum Laude (honors)

Academic Difficulty

Students having academic difficulty may be asked to withdraw from specific courses, be placed on academic probation, be academically suspended, or dismissed from the University.

Required Course Withdrawal—The Dean of Students Office 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 suspension or dismissal from the University (see below).

A student seeking an undergraduate degree is placed on academic probation when any of the following is true:

1. The University cumulative GPA is below 2.00.
2. The GPA for the most recent semester is below 2.00.
3. The cumulative departmental GPA is below 2.00, based on at least 16 credits.

A student on academic probation will be removed from probation when all of the following are true:

1. The University cumulative GPA is 2.00 or greater.
2. The GPA for the most recently completed semester is 2.00 or greater.
3. The cumulative departmental GPA is 2.00 or greater, based on at least 16 credits.

Academic 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 reenroll 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.

**Appeals of Academic Suspension/Dismissal**—Appeals of academic suspension/dismissal will be considered if students can document that there are unusual or extenuating circumstances surrounding their recent academic performance. They must also be confident that they will be able to show significant academic progress. Students wishing to make such an appeal must do so in writing to the dean of students.

**Reinstatement**—A student suspended for unsatisfactory academic progress may apply for a reinstatement through a written request to the dean of students 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 reenrollment.

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**

Students who withdraw from the university following one or more terms of poor academic performance occasionally return to the university to continue their education. Their prior low GPA may not be indicative of their potential and may pose a significant challenge to achieving university standards of acceptable academic performance. Prior low grades may also serve as a deterrent to re-enrollment to resume study. Academic Renewal is designed to give returning students a second chance by providing an opportunity to remove a certain portion of prior course work from grade point computation.

**Academic Renewal Qualifications**

1. A student enrolling at Michigan Tech after an absence of five (5) years or more may elect Academic Renewal. This renewal will affect only those courses taken prior to the five (5) year absence and may be elected only once Academic Standing will be initialized to ‘Good Standing’ for students electing Academic Renewal.

2. Academic Renewal is open only to undergraduate students admitted into a degree program. Academic Renewal is forfeited if a degree program is not completed.

3. Academic Renewal must be invoked prior to graduation and is not available to students who have previously completed requirements for a Michigan Tech Bachelor's or Associate's degree.

4. If more than one term is elected for Academic Renewal, the terms must be consecutive and have been completed within a maximum of two (2) calendar years for Bachelor's degrees or one (1) calendar year for Associate's degrees.

5. A student receiving a Bachelor's or Associate's degree from Michigan Tech must meet the University residency for graduation requirement in the interval between the most recent course work elected for renewal and the completion of courses at Michigan Tech.

6. To qualify for Academic Renewal, a student must have an overall GPA below 2.0 for the renewal period.

7. Renewal will apply to all courses taken during the period for which it is elected regardless of the grade earned. No course credit is granted for any courses in Academic Renewal terms. Academic Renewal courses are not subject to the existing Repeat Policy rules.

8. All courses and grades in Academic Renewal terms will remain on the student's transcript with a notation that “Academic Renewal has been granted”. All grades will be annotated with an ‘R’ indicating Renewal, e.g. RD or RF. Grades thus annotated will be excluded from University grade point average computation.
9. Academic renewal is a policy of Michigan Technological University. As such, students should be aware it may not be recognized by outside institutions or agencies (e.g. Michigan Department of Education, other universities and colleges).

10. Once elected, Academic Renewal is irrevocable. Students must consult with their academic advisor prior to election of Academic Renewal. Signed application forms will be processed and retained by the Registrar's Office.

Students may obtain a petition form through the Registrar’s Office and must consult with their academic advisor prior to election of academic renewal. Students who left the university voluntarily may re-enroll by contacting the Registrar’s Office. Those who did not leave voluntarily must seek re-enrollment through the Dean of Students Office. Requests are evaluated on a case-by-case basis.

**Conduct**

Attendance at Michigan Technological University is both voluntary and optional. Each member of the University community, by his or her matriculation at the University or by otherwise availing themselves of the benefits of the University, indicates that they agree to be bound by the Code of Community Conduct and all other relevant policies, rules, or regulations. The University considers freedom of speech and civil discourse to be essential to educational development and thus recognizes and values both freedoms provided by, and limits consistent with, the First Amendment. Students are free to engage in peaceful and orderly protest, demonstration and picketing that is consistent with the Code of Community Conduct and does not disrupt functions of the University. However, students and others are not permitted to engage in conduct that disrupts the University, the University community, or any of its constituent parts.

**Sex Discrimination/Sexual Harassment**—Michigan Tech must provide a fair and responsible environment for all of its students. Title IX of the Education Amendments of 1972 is a law prohibiting discrimination based on sex in educational programs that receive Federal funds. It states: "No person in the United States shall, on the basis of sex, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any education program or activity receiving Federal financial assistance."

The Assistant Vice President of Student Life and the Director of Student Activities are responsible for Title IX compliance for matters involving students. The Assistant Vice President of Student Life and the Director of Student Activities provide information about resources on campus, Public Safety and Police Services, and the Office of Academic and Community Conduct. They are also available for support.

For complaints against a student, a coach, or an administrator in athletics for sexual harassment, sex discrimination, or sexual assault, you may contact the Athletic Director, who will facilitate the handling of the complaint with the appropriate office, 906-487-3070.

The Title IX Coordinator for the university is the Director of Institutional Equity, 906-487-3310.

For more information, contact the Dean of Students Office, 906-487-2212 or visit the website.

For information on Student Conduct Policies, visit the website.

For information on sex discrimination / sexual harassment / sexual assault – you may also contact the Office of Institutional Equity, 906-487-3310 or visit the website.

**Substance Abuse**—The University encourages and promotes an environment where healthy lifestyle choices can be made every day by students, faculty, and staff. Students may obtain substance abuse consultation and counseling through Counseling Services. Michigan Tech is committed to following the guidelines of the Drug-Free Schools and Community Act of 1988.

Michigan Tech 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 his or her 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 "Alcohol and Other Drug Policy" available in the Dean of Students Office or here.

**Disabilities (ADA)**

Michigan Tech is dedicated to assuring and enhancing opportunities for students with disabilities. The University does not discriminate in the recruitment, admission, or treatment of students. A student with a documented disability may request appropriate modifications, accommodations, or auxiliary aids that will enable the student to participate in and benefit from educational programs and activities. Documentation must be provided by qualified medical and/or educational professionals, with specific recommendations for appropriate accommodations. The Coordinator for Student Disability Services, in consultation with the student, will review these recommendations before implementation. To request accommodations, a student must present documentation to the Student Disability Services (SDS) Office. It is the student's responsibility to inform the SDS Office of their class schedule for each term in which accommodations are sought. Letters, when appropriate, will be prepared for instructors informing them of the student's need for accommodation (such as extended time to complete examinations, permitting examinations to be individually proctored, or permitting the use of tape recorders in the classroom). Other out-of-class accommodations may be requested and approved, depending on documentation. Please see the Student Disability Services web page.

**Grade Reports**

**Mid-Semester Grades**—Grades of "satisfactory" (C or better) 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 Student Service Center 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 Michigan Tech Student Service Center. Transcript requests are processed as they are received, and turnaround 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 Michigan Tech since 2003, you can log into Banweb (Student Information System). Enter your campus username and ISO password to login. Once you have gained access, click on student services, student records, then select an official or unofficial transcript. If you have questions, email registrar@mtu.edu or contact the Student Service Center at 906-487-2319.

Students who attended prior to 2003 may request a transcript in person, by mail, or by fax.

**Request in Person**—Come to the Student Service Center with your Michigan Tech ID 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 appropriate identification.

**Request by Mail**—To request a transcript by mail, include your name, Michigan Tech 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, Student Service Center, 1400 Townsend Drive, Houghton, Michigan 49931.

**Request by Fax**—To request a transcript by fax, include your name, Michigan Tech 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 any unofficial transcript be faxed.
Grading Policies

Grade Point Average (GPA)—The grade and credit earned for any course taken by a student at Michigan Tech 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—It is required that a student earn a minimum cumulative 2.00 GPA and a minimum 2.00 GPA in the student’s major department for an undergraduate degree. 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)—not computed in GPA calculation appropriate when
  - the student has a legitimate extenuating circumstance prohibiting the completion of the course;
  - the student has the ability to complete the course requirements without re-enrolling in the course;
  - the student currently has a passing grade in the course.

Extenuating circumstances may include (but are not limited to):

- car accident
- sudden illness or injury (Doctor’s office/hospital documented)
- birth of a child
- death of a family member
- conditions of close friends (suicide, accident/injury)
- divorce (individual and parental)

An incomplete grade must be made up within 1 semester of being assigned regardless of residency according to the following schedule:

- assigned fall semester: course must be completed by the end of spring semester;
- assigned spring semester: course must be completed by the end of fall semester;
- assigned summer semester: course must be completed by the end of fall semester.

An I grade should not be used as a substitute for a failing grade or a withdrawal.

Failure to complete the coursework within the timeframes defined above will result in the conversion of the I to an F.

Incomplete grades at graduation are considered (F) grades in computing the final grade point average

- IS (in-session)—given when course remains in session after the term’s final grade deadline.
- **X (conditional)**—computed into the grade point average as an (F) grade 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. An X is appropriate when:
  - the student does not have a legitimate extenuating circumstance for failing to complete course requirements that meets the standards for the I grade (above);
  - the student has the ability to complete the course requirements without re-enrolling in the course;
  - the student currently has a passing grade in the course.

Example circumstances appropriate for an X grade may include:
  - oversleeping on the day of an exam
  - flat tire/unexpected car trouble
  - incomplete assignments.

X grades must be made up within the next semester according to the same schedule summarized above for the I grade. Failure to complete the course accordingly will result in the conversion of the X grade to 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. 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 tenth week; after the tenth week, a student may only request a late drop from the Dean of Students Office, 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 letter grades of A to 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 letter grades CD to 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 Grade Option**—Requests to change from a normal grade mode (A-F) to audit for a course must be received in the Registrar’s Office by the close of business on Wednesday of the second week of the semester (the last day to add/drop a course). Audited courses may not be used to fulfill academic requirements.

**Pass-Fail Grade Option**—Requests to change from a normal grade mode (A-F) to pass-fail for a course must be received in the Registrar’s Office by the close of business on Wednesday of the second week of the semester (the last day to add/drop a course). Courses taken for a letter grade may not be repeated under the pass-fail option. Courses taken under the pass-fail option may only be used to fulfill free electives.
Graduation Requirements

The Michigan Tech Catalog is updated annually and requirements for degree programs may change from one catalog year to the next.

Students maintaining continuous enrollment at Michigan Tech may expect to graduate under the requirements published in the University catalog in effect at the time of their matriculation. Students who change majors will follow the requirements in effect at the time of the change.

Students who add a major, minor, or certificate will follow the requirements for the additional curriculum in effect at the time it is added.

Students who have been absent from the University for one or more years will follow the degree requirements of the catalog in effect at the time of readmission.

Students should consult with their academic advisor for guidance when considering options in regard to their individual plan.

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

1. Thirty of the last 36 semester credit hours of academic work to be applied to the degree must have been completed at Michigan Tech. 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.

2. Thirty 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.

Each degree candidate is expected to:

1. Successfully complete the required courses prescribed for their chosen curriculum.
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 a graduation application with the Registrar's Office for each degree or certificate program the candidate intends to complete.
6. Have an approved degree audit on file with the academic advisor for each academic program in which enrolled.

Undergraduate Commencement Eligibility Requirements

Michigan Tech conducts two commencement ceremonies each year that 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 senior coordinator of degree services in the Registrar’s Office.

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

- Be registered in the course(s) that will complete all outstanding program requirements.
- Have an approved audit on file with the academic advisor for each academic program in which enrolled.
- Have a graduation application on file for each degree and certificate in which enrolled in the Registrar’s Office two semesters prior to the expected graduation term.
Participation in a commencement ceremony is NOT equivalent to graduation. Since the ceremony may occur before final grades are submitted, it is not possible to determine if all degree requirements have been 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. These rights include:

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.

   A student should submit to the registrar, dean, head of the academic department, or other appropriate official, a written request that identifies the record(s) the student wishes to inspect. The University official will make arrangements for access and notify the student of the time and place where the records may be inspected. If the records are not maintained by the University official to whom the request was submitted, that official shall advise the student of the correct official to whom the request should be addressed.

2. The right to request the amendment of the student's education records that the student believes are inaccurate, misleading, or otherwise in violation of the student's privacy rights under FERPA.

   a. A student who wishes to ask the University to amend a record should write the University official responsible for the record, clearly identify the part of the record the student wants changed, and specify why it should be changed.

   b. If the University decides not to amend the record as requested, the University will notify the student in writing of the decision and the student's 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 provide written consent before the University discloses personally identifiable information from the student's education records, except to the extent that FERPA authorizes disclosure without consent.

   a. The University discloses education records without a student's prior written consent under the FERPA exception for disclosure to school officials with legitimate educational interests.

   b. A school official is a person employed by the University in an administrative, supervisory, academic or research, or support staff position (including law enforcement unit personnel and health staff); a person or company with whom the University has contracted as its agent to provide a service instead of using University employees or officials (such as an attorney, auditor, or collection agent); a person serving on the Board of Control; or a student serving on an official committee, such as a disciplinary or grievance committee, or assisting another school official in performing his or her tasks.

   c. 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 responsibilities for the University.

4. The right to file a complaint with the US 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
   US Department of Education
   400 Maryland Avenue SW
   Washington, DC 20202-5901

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, email address, hometown, age, college, major field of study, class (senior, junior, sophomore, freshman), 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, Michigan Tech 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,” 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 Registrar’s Office. 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, Registrar’s Office, 1400 Townsend Drive, Houghton, MI 49931-1295. The complete policy is available on the Registrar’s Office website.

University Information and Freedom of Information Act

Michigan Tech is committed to maintaining a free exchange of information throughout the University community. 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 at 906-487-2200.

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, 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 Schedule of Classes can be found on the web at Prepare for Registration.

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

Dropping Classes—Courses dropped by the close of business on Wednesday of the second week of the semester* will be refunded 100 percent. 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 tenth 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.

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

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

After the tenth week of a semester, a student may request a late drop from the Dean of Student’s Office which will consider only those requests that clearly involve extenuating circumstances beyond a student’s control. The course will appear on the student’s transcript with a grade of W.

NOTE: Students who drop all of their classes will be withdrawn from school as of the date those classes were dropped.

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.

Prerequisites—Prerequisite courses are required to be satisfactorily completed before a student may register in a course requiring the prerequisite. Students who earn a CD or D in a prerequisite course should 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.

Corequisites: courses that are required to be taken together in the same semester.

The course instructor has the right to waive a prerequisite in the case of a student who has demonstrated competence or who has 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 class without the student officially taking the prerequisite course.

Repeating a Course—Undergraduate 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 standing. 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 dean of students 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.

In situations where an original course is no longer offered and no active direct equivalent exists, students may seek the permission of their academic advisor and their department chair or school dean to substitute a different course (a "similar repeat") that covers comparable material at a similar level.

Curriculum Changes—Undergraduate students considering a change of 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 Add/Drop form, available in the department academic advising offices. The student must complete the form, have it signed by the appropriate academic advisor, and submit it to the Registrar’s Office 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 Add/Drop form can be used to add, drop, or change a concentration, minor, a double major, or a second degree. Questions may be directed to registrar@mtu.edu.

Download Curriculum Add/Drop form.

Enrollment in Graduate Courses under “Senior Rule”—While completing an undergraduate degree, students are permitted 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 Registrar’s Office prior to the end of the sixth 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.

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 course work during the semester, registration must be formally withdrawn. Failure to submit a 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 an established refund schedule. Notifying the Registrar’s Office helps ensure a smooth withdrawal-readmission process. Students may do this over the telephone, through the mail, or by 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 Michigan Tech students who are called to active military duty will be given the opportunity to work out the best possible solution for maintaining their academic status. 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 or she returns to the University.
Student Resources

Activities
Looking to get involved? Well, you found the right place! Student Activities, located in room 112 of the Memorial Union Building, offers a variety of activities for you to get involved with on-campus and in the community. Stop in and see us, call us at 906-487-1963, or email us at activities@mtu.edu. Student Activities consists of: Greek Life, Leadership, Registered Student Organizations (RSO), Community Service, Wellness, the Outdoor Adventure Program (OAP), and Campus Programs & Traditions. We look forward to meeting you!

Student Organizations
More than 200 student groups are registered on campus, including political, cultural/ethnic, social, special interest, media, honorary, religious, service, leadership, and professional organizations, as well as fraternities, sororities, and club sports groups. For a full listing of the current registered student organizations please click here. Keweenaw Day (K-Day), the Spring Involvement Fair, and Spring Fling events are excellent times to learn more about student groups.

Undergraduate Student Government (USG)
USG is the voice of the undergraduate student body. This group works with students to help resolve campus issues and oversees the disbursement of the revenue collected through the student activity fee. The USG office is located on the first floor of the Memorial Union Building.

Support Services
ECE Women's Center
The ECE Women's Center is located in the heart of campus in the EERC Building, room 734. It is a quiet space where students are welcome to study, meet with other students, or relax between classes. All majors welcome. The center includes ECE test equipment, comfortable furniture, and tables for studying.

Counseling Services
Counseling Services provides student-centered services and programs. Our goal is to help students deal with life’s everyday challenges and problems by providing professional support. We also offer various wellness programs that focus on helping students create a healthier lifestyle and positive self-image.

Counseling Services provides personal and academic counseling. Students may meet individually with a counselor to address any concerns or problems they have, including depression, anxiety and stress, adjustment to college, eating disorders, date rape, pregnancy, relationship or family problems, sexuality, self-esteem, substance abuse, or others. Counselors can also assist students in improving time management and study skills and interpersonal communication skills. Additionally, Counseling Services offers group counseling. Small groups of students may meet to discuss and deal with issues such as eating disorders; grief; substance abuse; recovering from rape, sexual assault, and sexual harassment; or any other area of need.

Counseling Services also contracts with Portage Health so that students have access to a nurse practitioner who can prescribe and/or coordinate the student's medication and prescription needs with their physician or psychiatrist.

Counseling Services is located in the Administration Building, room 301. All services are confidential and free of charge for students. To make an appointment, call 906-487-2538 during regular business hours (Monday-Friday, 8:00 a.m.-5:00 p.m.). To request a workshop or presentation, call 906-487-2538 or email counseling@mtu.edu.

Career Services
Career Services is designed to meet the career planning, preparation, and placement needs of all undergraduate and graduate students and alumni of Michigan Tech. Services include educational seminars, a one-credit career development course, career fairs, individual advising, resume writing and critiquing, mock interviewing, on-campus interviewing, corporate presentations, and new interactive career-guidance software programs. All services are free to Michigan Tech students and alumni.
Students are encouraged to visit Career Services early in their academic career. By participating in a co-op or a summer internship, learning job search skills, and being introduced to the corporate world, students will be well prepared for permanent employment upon graduation.

Students are also encouraged to attend the semiannual on-campus career fairs where hundreds of companies come to meet and recruit Michigan Tech students. This is one of the best opportunities to obtain co-op, summer internship, and permanent employment positions.

Visit the Career Services' website for a complete description of the numerous services and benefits that are available.

**Wahtera Center**
The Wahtera Center for Student Success is dedicated to assisting students define clarify, and achieve their academic, personal, and professional goals. Services include individual staff support, peer Academic Success Coaches, and academic success workshops. Contact the Center at success@mtu.edu for assistance.

**University Events**

**K-Day**
At the start of the fall semester, all students are invited to McLain State Park on Lake Superior for a day of fun, sun, music, games, and food. Student organizations sponsor booths so students can learn about the many opportunities available on Tech's campus. The day is a celebration of the beautiful Keweenaw Peninsula, home to Michigan Tech. Classes are dismissed at noon so that students and faculty can celebrate and participate in the activities.

**Parade of Nations**
The Parade of Nations, held in September, celebrates diversity with a colorful parade, complete with floats, bands, and flag-bearing students representing our students' nations. Following the parade, students, faculty, and members of the community gather at the Multicultural Festival for a celebration of food, culture, music, and dance.

**Homecoming**
Few homecoming festivities on any campus can rival Michigan Tech's for zaniness and all-around fun! In addition to the football game and the crowning of the homecoming king and queen, the celebration features a parade, a cardboard boat race, competitive challenges, and many other events to promote Husky spirit.

**Family Weekend**
Each fall semester, parents and families are invited to the Keweenaw Peninsula during Family Weekend to explore campus, attend cultural events, cheer the Husky teams to victory, and tour the Copper Country and experience the vibrant fall color. Family Weekend is a time for parents to visit with their student, experience university life, and create fond family memories at Michigan Tech. Visit the Family Weekend website for dates and specific event information.

**Winter Carnival**
No Michigan Tech tradition can match Winter Carnival for national fame and overall involvement. 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 carved by students, a home hockey series, men's and women's varsity basketball, skits, broomball and other sports, sleigh rides, a Winter Carnival Queen, and more midwinter fun! Winter Carnival is held in early February during a two-day class break.

**Spring Fling**
Spring Fling is a recognized University Tradition and is the Friday of Week 13 of the Spring Semester. Student groups gather on-campus for food, music, and fun as they usher in the beginning of spring and celebrate the end of the school year. Sponsored by the Memorial Union Building Board.
Visual and Performing Arts
The Department of Visual and Performing Arts presents a variety of theatrical and musical performances and art exhibits for the campus and local community throughout the year. Students play significant roles as managers, designers, production staff, and performers, working side by side with the faculty in art, music, and theatre. Opportunities for students include:

- **Music**—Students, faculty, and community residents participate in musical ensembles, including Concert Choir, Superior Winds Symphony, Huskies Pep Band, Jazz Lab Band, R&D Big Band, the Keweenaw Symphony Orchestra, and other jazz and chamber groups. The department also sponsors a performance series for UP and northern Wisconsin musical groups.

- **Theater**—Each season offers a full range of theatrical genres and styles, including comedies, classics, musicals, and experimental productions. Guest artists are invited to perform with students.

- **Visual Arts**—Courses in watercolor, sketching and drawing, three-dimensional design and sculpture, ceramics, and graphic design are offered each year. In addition, the visual arts program sponsors residencies and workshops by professional artists and offers opportunities for students to exhibit their work, as well as sponsors the Great Lakes Showcase, an exhibition for professional artists.

Cultural Enrichment
The University sponsors a wide variety of cultural events and activities, including art exhibits, dance and theater touring companies, musical ensembles, performing artists, comedians, and lectures by topical (and often controversial) speakers. The beautiful [Rozsa Center for the Performing Arts](#) is host to many of these events, allowing our students to broaden their cultural education and enjoy an amazing array of high-quality entertainment. This state-of-the-art facility not only enhances the quality of life on Michigan Tech's campus and the local community, but also provides our students with numerous educational and practical opportunities for hands-on experience in backstage and front-of-house crews.

Athletics
**Intercollegiate Athletics (NCAA)**
Michigan Tech, with its rich tradition in intercollegiate athletics, currently competes in 14 sports: Division I men’s ice hockey and Division II football, men’s and women’s basketball, women’s volleyball, women’s soccer, men’s and women’s tennis, men’s and women’s cross country, men’s and women’s track and field, and men’s and women’s Nordic skiing.

The tradition of Huskies’ success includes three national championships by the ice hockey team, a national runner up finish by the women’s basketball team and dozens of conference titles along the way. Every team sport has reached the NCAA Tournament level during the last decade, and numerous student-athletes from the individual sports have advance to the NCAA Championships in that time frame.

**Intramural-Recreational Sports Services Department**
The Intramural-Recreational Sports Services department provides a wide variety of recreational activities that appeal to the leisure-time pursuits of students, faculty, and staff.

We encourage that participation be for fun, fitness, and friendship. We pro-mote and honor individual and team sportsmanship. We provide the opportunity for students to compete against and interact with other students, thus promoting good citizenship and socialization. Student employees develop social and leadership skills that are essential for lifelong learning.

The Intramural-Recreational Sports Services program is designed to be consistent with the educational objectives of Michigan Tech.

**Recreational Facilities**
The Student Development Complext (SDC) features a variety of high-quality facilities/amenities, including:

- Youth and adult classes, plus regularly scheduled fitness and recreational opportunities.
- The main athletic complex, with a fitness center; ice arena; multipurpose room with climbing wall, racquetball and squash courts; dance/fitness studio; shooting range; swimming pool and dive tank; varsity gym; top-level locker rooms (with showers, saunas, and towel service); classrooms; and more.
- Gates Tennis Center, featuring professional-grade indoor courts, lockers, showers, and a pro shop.
Outdoor recreation areas such as our recreational forest and trails, softball fields, sand volleyball courts, Sherman Field, Hubbell Field, soccer fields, and disc golf.

Michigan Tech students have access to the SDC through student fees. Faculty, staff, and community members can purchase memberships in a variety of price and length options. Daily passes are also available.

**Student Development Complex (SDC)**
Michigan Tech’s Student Development Complex provides year-round recreational and fitness activities for students, faculty, staff and the entire community to encourage a healthier lifestyle. Michigan Tech students use the SDC as part of their student fees, while faculty, staff and community members pay a reasonable fee.

The athletic complex features classrooms, a dance room, fitness center, ice arena, multipurpose room, racquetball and squash courts, rifle range, swimming pool and dive tank, and varsity gym. Spacious men's and women's locker rooms include saunas, showers, and a towel service. Patrons can check out a variety of recreational equipment, including basketballs, volleyballs and racquetball racquets. Adjacent to the SDC is the Gates Tennis Center with indoor courts, a pro shop, lockers and showers. Outdoor recreation areas include the recreational forest and trails, softball fields, sand volleyball courts, Sherman field, Hubbell field, soccer fields and disc golf.

For information about any of these areas, including reservations and rental opportunities, call 906-487-2578.

**Gates Tennis Center**
The staff at Gates Tennis Center invites you to enjoy the newly resurfaced indoor courts. The center has lockers and showers as well as pro shop for most of your equipment needs. We also offer racquet stringing and tennis lessons.

If you play tennis daily, or only a couple of times a month, a pass to the Gates Tennis Center is an economical way to enjoy your favorite sport.

Purchase a pass today and save! For reservations, call 487-2774.

**Other facilities (on and off campus)**

**Mont Ripley Ski Hill**
Mont Ripley Ski Hill is owned and operated by Michigan Tech and is located two miles north of Houghton, across the Portage Canal in Hancock. Mont Ripley is part of the Experience Tech Fee. To access the hill, just show your student ID and receive your daily ticket. Mont Ripley features:

- Over 100 acres of terrain
- Over a 100 day season
- Night skiing 7 days a week
- 2 chairlifts and a T-bar
- Snowmaking on 100% of the hill
- PE classes
- Multiple terrain parks
- Chalet with a cafeteria
- Season lockers
- Ski and snowboard rentals for the day or season
- Pro shop

**Nordic Ski Trails and Recreational Forest**
Michigan Tech's trail system is located right across the street from the Student Development Complex or the south end of the Michigan Tech campus on MacInnes Drive. The 35 kilometers of trails are great for biking, hiking, and cross country skiing.

The Tech Trails are nationally recognized for the quality of skiing, consistency of grooming, and variety of terrain. The 35 kilometers of trails are among the best skiing in the Midwest. The trail system, with the help of hundreds of volunteers, hosted the 2006 junior national championship, and the 2007 and 2008 U.S. championships. Grooming takes place daily and the system includes 7.5 kilometers of lighted trails, making an after-class outing a breeze for students.
With Houghton’s average snowfall approaching 250 inches, the season usually opens in early December and continues into April. Students ski free; community members can purchase a reasonably priced pass. The university also participates in a four-trail pass system, providing access to almost 100 kilometers of skiing throughout the Keweenaw Peninsula.

**Portage Lake Golf Course**
The only 18-hole golf course in the Keweenaw. Opened in 1903, a challenging and traditional course located three miles south of Houghton, it features the following:

- Online reservations - internet specials
- Quality merchandise
- Individual or group adult & junior lessons
- Men’s, women’s, junior & student leagues
- Bar & grill
- Practice facilities
- Rental carts & clubs
- Four sets of tees for golfers of every level

**Health Care**

**The Portage Health University Center**—Located on the Michigan Tech campus adjacent to the Student Development Complex on MacInnes Drive, the Portage Health University Center provides primary medical care for the community and Michigan Tech students, their spouses, and their dependents on a fee-for-service basis. Fees are payable to Portage Health (906-483-1860) and are not billed by the University.

Portage Health also operates an Express Care service (906-483-1777) located at 921 W. Sharon Avenue, Houghton. They also have an after-hours walk-in clinic and hospital emergency care at 500 Campus Drive, Hancock, (906-483-1000).

**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 the Student Insurance page.

**Housing**

**Housing Policy**—All unmarried students are required to live in University residence halls during their first year of attendance at Michigan Tech. This policy does not apply to transfer students, graduate students, or commuting students living at home with their parent or guardian.

Students receiving a National Scholars Program, Presidential Scholars Program, or Leading Scholars Program award are required to live on-campus for the first two academic years (four academic-year semesters) not including summers, at the University.

Students currently living in the residence halls are guaranteed a place for the following academic year, provided they sign up for housing by the end of spring semester. Students should clarify their status with Housing and Residential Life prior to making an off-campus housing commitment.

**Residence Hall Contract**—A residence-hall application and contract for accommodations will be sent by the Admissions Office when an applicant is accepted for admission. Priority residence-hall and roommate-preference requests are considered based on the date a completed contract is received. Applications are also available online.

**Residence Halls**

**Facilities**—Douglass Houghton Hall, McNair Hall, and Wadsworth Hall together 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 has some rooms available with a private bath. All residence halls are smoke-free environments.

**Lifestyle Options**—Unique living options include alcohol-free housing areas and the Learning Communities.

**Alcohol-free** housing is offered in all three of the residence halls. The use and/or possession of alcohol and/or alcohol-related items in the house are not permitted by the residents or their guests.

**Learning Communities** are unique residence-hall living areas designed to enhance life at Michigan Tech by grouping students with common interests. Learning Communities blend programming with additional staff to help students achieve personal and academic success. For more information, please visit the website.

- **Computer Science Learning Community (CSLC)**—The Computer Science Learning Community (CSLC) consists of students who share academic interests in the field of Computer Science. The CSLC is geared towards students majoring in Computer Science, Software Engineering, and Computer Systems Science. This community brings together students, staff, and faculty who share a passion for computers and computer related technology. Through various programs and activities, CSLC students will have the opportunity to get involved, make friends, and study and learn together in a supportive environment.

- **Forest Resources and Environmental Science Learning Community (FRES)**—The Forest Resources and Environmental Science (FRES) Learning Community combines academics and an appreciation for the natural world. This close-knit community is designed for students seeking degrees in forestry, applied ecology and environmental sciences, and wildlife ecology and management. Students in the FRES community benefit from interactions with faculty inside and outside the classroom as well as numerous fun social activities in the FRES community.

- **First Year Experience (FYE)**—As a member of the First Year Experience (FYE) Learning Community, you have the unique opportunity to live in a community with other first-year students and experience Michigan Tech together for the first time. FYE helps make your transition to college easier by providing extra peer staff and numerous opportunities to get to know others in the residence halls and the Michigan Tech community. FYE emphasizes a community atmosphere where everyone works together to build and develop a positive community that is not only fun, but also is one that promotes success in academics as well.

- **The Summit**—The Summit Learning Community is all about the wellness of the mind, body, and spirit. In Summit, you can focus on academic success in an alcohol-free environment with others who are interested in living an active lifestyle. In Summit the staff and students recognize that wellness and success is different for each student, so you will have opportunities to participate in a variety of fun programs that revolve around intramural sports, outdoor activities, campus traditions, and so much more.

- **Global Village**—Global Village is an inclusive global community that encourages and welcomes individuals who want to learn about other countries, cultures, and people. Whether you are thinking of possibly studying abroad in the future, or if you just want to live and learn with a group of people with diverse backgrounds, Global Village will be a great fit for you. In addition to the many fun activities and programs, this Learning Community works with International Programs and Services (IPS) to make sure that students are aware of the great opportunities and support available to them during their time at Michigan Tech.

- **Leadership Learning Community (LLC)**—The Leadership Learning Community (LLC) is a community where students will learn about and develop leadership and are encouraged to put their skills into practice. Here, you can learn what kind of a leader you are and how to incorporate and balance leadership in your everyday life. In this team environment, you can develop your skills and take advantage of the countless opportunities Michigan Tech offers to advance as a leader even further.

- **Visual and Performing Arts Learning Community (VPALC)**—The Visual and Performing Arts (VPA) Learning Community is designed for anyone interested in the arts (music, dance, graphic design, photography, theater, etc). In the VPA community, you will have plenty of opportunities to get involved and get to know others through a variety of programs and activities. Students in the VPA Learning Community also have unique opportunities to build relationships and network with talented and experienced departmental staff, faculty, and other students who share these interests and passions.

- **Women In Engineering**—The Women In Engineering Learning Community brings together female engineering students and provides support as they pursue careers in the field of engineering. This close-knit community offers a team-oriented atmosphere for women who want to be successful in their academics while also enjoying everything Michigan Tech has to offer. Students in the WIE community will enjoy extra faculty interaction, opportunities to network and get involved with the Society of Women Engineers (SWE), and a wide array of fun programs and activities.
Dining Services
All residents must choose a meal plan. The Platinum, Gold, and Silver Meal Plans offer anytime-dining (unlimited access) during regular hours of operation. Dining Dollars, which allow students the flexibility to eat outside the residence dining halls at campus retail locations, may be added to a meal plan. The Platinum, Gold and Silver Plans include $300, $150 and $100 respectively in Dining Dining Dollars per semester. Each Meal plan includes Guest Meal Passes, which allow the meal plan holder to treat a guest in Wadsworth, McNair, or Douglas Houghton dining centers. The Platinum, Gold, and Silver plans include 16, 8 and 4 guest meals respectively.

Residence Life Staff
Our residential buildings have full-time Residence Life Coordinators that live in each hall and maintain regular office hours. They provide information, guidance, and aid in dealing with academic or personal issues. Residents are encouraged to seek their assistance with any questions. For a listing of the staff available to assist you, please visit the website.

Michigan Tech Apartments
The University maintains 343 one- and two-bedroom apartments at Daniell Heights. The apartments overlook campus and are convenient to both the campus and the Student Development Complex. Rates depend upon the type of contract and occupancy. All utilities, except for telephone, are provided. Residents who sign up for local phone service receive domestic long-distance service free. Every apartment is furnished, including an electric stove and refrigerator. Each building of six to eight apartments shares a washer and dryer for a small fee.

Picnic tables and children's play areas are located throughout the apartment area. Other amenities include a basketball court, a sand volleyball court, high-speed computer access, an activity room, bike storage, and free bus service between the apartments and the main campus during the regular academic year. For more information please visit the website.

Michigan Tech opened a 192-bed residential apartment building in the fall 2010 called the Hillside Place located in the on-campus residential community. Amenities include a cleaning service twice per month, gender-neutral housing, Internet, cable, air conditioning, and in-floor heating. For more information please visit the website.

Off-Campus Housing
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. To assist students in locating off-campus housing, the Undergraduate Student Government (USG) maintains a list of off-campus householders renting to students; this list is available online.

Support Services
Child Care
Little Huskies Child Development Center is accredited by The National Association for the Education of Young Children. It is located on campus between the Gates Tennis Center and the U. J. Noblet Forestry Building on MacInnes Drive. Little Huskies research based curriculum encourages and supports the growth and development of young children, from infants to kindergartners, in a caring and nurturing environment. The center helps to attract and support world-class faculty, staff, and students. The center is one of the many people-focused work/life initiatives intended to provide an outstanding educational and work environment for Michigan Tech students, faculty, and staff.

The center gives priority to children whose parents or legal guardians are students or employees of Michigan Tech, although children from the community are welcome and may be admitted at an increased tuition rate. For more information, please contact the center’s director, Eva-Marie Hatfield, at 906-487-3528.

International Programs and Services (IPS)
The International Programs and Services Office (IPS) is the unit which oversees the admission of undergraduate international and ESL students, administers study abroad programs in over 30 different countries, and provides cultural and transition support for over 1,000 international students and scholars holding F-1 and J-1 visas. Serving as the liaison to the Department of Homeland Security and the United States Citizen and Immigration Service, IPS staff advises the university and international students on all matters related to international student and exchange visitor visa compliance.
IPS also assists academic departments with the development of student, faculty, and research exchange agreements with international universities. IPS significantly contributes to the internationalization of Michigan Tech and the Upper Peninsula communities by sponsoring multiple cultural and educational programs, including the Parade of Nations, New International Student Orientation, and informational workshops throughout the year. IPS also offers intercultural-communication training for the campus community.

Center for Diversity and Inclusion

Mission Statement
The Center for Diversity and Inclusion provides support and development that enriches the intellectual, social and professional growth of Gay, Lesbian, Bisexual and Transgender (GLBT) students, students of color, and women. The Center for Diversity and Inclusion assists Michigan Technological University with the recruitment, retention and successful graduation of underrepresented students.

Our Vision
The Center for Diversity and Inclusion is a resource for preparing and empowering socially conscious leaders to create the future.

About Us
The Center for Diversity and Inclusion offers workshops and programs that focus on multicultural, diversity social justice. The Center for Diversity and Inclusion provides academic, personal, educational and support programs for students.

Contact the Center for Diversity and Inclusion at diversitycenter@mtu.edu, at 906-487-2920, or visit our website.

Information Technology
The Office of Information Technology (OIT) provides the foundation for Michigan Tech's computing environment and manages the network, data, telephone, video, applications, and systems infrastructure needed to support the University's education, research, and community-service missions. The OIT also manages the wired and wireless networks in the residence halls and student apartments.

User support for any issues related to IT may be obtained by calling User Services at 487-1111, by sending an e-mail to User Services at it-help@mtu.edu, or by visiting the main lobby in the Library. For further information, including the Help Desk hours, visit www.it.mtu.edu.

Student Affairs Office
The Office of Student Affairs provides support to students in cocurricular and extracurricular areas, enriching and supporting the academic experience of students. Its goal is to create the best possible environment for the professional and personal growth and development of students. The Student Affairs staff also helps students resolve issues and problems.

Cultural and Educational Resources

Library
The Van Pelt and Opie Library is the heart of campus for study, collaboration and innovation with an array of people and services to help you navigate through the worlds of academic information and technologies. Librarians and staff stand ready to assist students, on-site and virtually, with research, projects and course assignments.

Study and connect wirelessly in the beautiful 24 hour-accessible reading room, work together in 22 study rooms (bookable through the library's mobile site), instructional classrooms and a variety of open spaces and nooks – there are vibrant or quiet options to suit your study preferences.

Time-saving and convenience services include a help desk offering one-stop services to support your information technology and information services questions and needs, check-out of tools including laptops, calculators and cameras, and a café with coffee, sandwiches and snacks. A variety of high end and large sized scanners and poster printing, complete with software for creative production are available throughout the library.
By working with your instructors, the library promotes information literacy, a valuable and time-saving skill for your academic success and to enable informed decision-making and life-long learning. The library contains 800,000 physical publications such as books, journals, US and Michigan government documents and a vast archive of print, manuscript and graphic resources covering the history of the university and of the western Upper Peninsula region. Access to thousands of e-journals, e-books and other digital resources, including the Keweenaw Digital Archives, a photographic history of the Copper Country is available on or off-campus (using your ISO login).

Check out the online help to connect to us via phone, IM and e-mail or visit us in the library for a librarian consultation focused on your needs. Search online for resources using the catalog, databases for finding articles and e-journals and librarian-created, time-saving guides offering starting points for many courses and broad disciplines. Visit the library and tell us how we can help. We are committed to your success at Michigan Tech.

The Library and IT Service Center, located in the lobby of the Van Pelt and Opie Library, is a one-stop information and technology help desk focused on the needs of Michigan Tech students. Questions ranging from assistance with campus and mobile computing to starting an academic project using useful and reliable tools and resources can be answered quickly or the student will be directed to an expert for more in-depth assistance. These services are also available to students through ithelp@mtu.edu or library@mtu.edu.

**Bookstore**
The Campus Bookstore is your source for textbooks, school supplies, computer software and accessories, general books, and Michigan Tech apparel. Don't forget to check out the Dress For Success Shop. The Campus Bookstore also provides mailbox and locker rentals in the Memorial Union Building, postage stamps, a Kodak photo printing kiosk, laminating, and UPS shipping.

**A.E. Seaman Mineral Museum**
The A.E. Seaman Mineral Museum is one of North America's great mineral museums. It is the Mineral Museum of Michigan and exhibits the largest collection of minerals from the Great Lakes region. The world’s finest collection of Michigan minerals, as well as outstanding minerals from around the world are on public display. Experience the splendor and beauty of natural art - minerals- at Michigan Tech’s A.E. Seaman Mineral Museum. The museum is located at 1404 E. Sharon Avenue in Houghton (near the corner of Sharon and Garnet, across from the Michigan Tech softball fields). Winter/Spring hours: 9:00am-5:00pm, Monday-Friday (January 14 to May 31, 2013). Summer/Fall hours: 9:00am-5:00pm, Monday-Saturday (June 1 to December 21, 2013). Visit the website for holiday closures and additional special event public hours at the museum. Free admission for all Michigan Tech students with ID.
General Education

General Education Goals

General Education is an important and required component of every Michigan Tech degree. Accreditation by the Higher Learning Commission requires that general education “imparts broad knowledge and intellectual concepts to students and develop skills and attitudes that the institution believes every college-educated person should possess.” At Michigan Tech, the General Education program enables all students, regardless of major, to develop an understanding of science and the social and cultural contexts of our contemporary world. The goals of the General Education program are included in the University Student Learning Goals:

- Knowledge of mathematics and the physical sciences
- Global literacy and human culture
- Critical and creative thinking
- Communication
- Information literacy
- Values and civic engagement

General Education Curriculum

The General Education curriculum consists of the following requirements:

- Four core courses (12 credits)
- Humanities, Arts, and Social Sciences (HASS)/Distribution requirement (12 credits)
- Science, Technology, Engineering and Math (STEM) requirement (16 credits)
- Cocurricular activities (3 semester units, typically 6 half-credit classes)

General Education Requirements

General Education requirements are not normally waived, substituted, or modified. Advisors may submit requests if students have received incorrect advice. Requests are reviewed on an individual basis by Helene Hiner or Christa Walck for the General Education Council.

Core Courses (12 credits) The core courses emphasize developing competencies in the six General Education Learning Goals.

Composition (UN1015) – 3 credits. This first-year writing intensive course emphasizes developing competencies in communication and information literacy.

Global Issues (UN1025) – 3 credits. This first-year course emphasizes understanding human cultures and developing competencies in global and information literacy.

Modern Language Option for Global Issues (UN1025). A 3000 level language course or higher may be used in place of UN1025 Global Issues. Students with prior language background who have completed Michigan Tech's WebCape modern language placement exam online must take the validation course on campus and receive a grade of B or higher to receive advanced placement credit for lower level language courses. Students with transfer or AP language credit, or who plan to study abroad, should see the humanities department modern language director for advice.

Humanities & Fine Arts (HUFA) 2000-level courses. Students must take 3 credits from the following list that emphasizes critical and creative thinking.

- FA2330 Art Appreciation
- FA2520 Music Appreciation
- FA2820 Theater Appreciation
- HU2130 Introduction to Rhetoric
- HU2501 American Experience in Literature
Social and Behavioral Sciences (SBL) 2000-level courses. Students must take 3 credits from the following list that emphasizes knowledge of human culture & global literacy and values & civic engagement.

- EC2001 Principles of Economics
- PSY2000 Principles of Psychology
- SS2100 World Peoples and Environments
- SS2200 Prehistory and Archaeology
- SS2400 Introduction to Human Geography
- SS2500 Introduction to History: US to 1877
- SS2501 Introduction to History: US since 1877
- SS2502 Introduction to History: Europe to 1650
- SS2503 Introduction to History: Europe since 1650
- SS2504 Introduction to History: World to 1500
- SS2505 Introduction to History: World since 1500
- SS2600 American Government and Politics
- SS2700 Introduction to Sociology

HASS (Humanities, Arts, Social Sciences) (12 credits; prior to Fall 2013, 15 credits)

Students must take 12 credits from the Humanities, Arts, and Social Sciences (HASS) Distribution List with the following limitations:

- 6 credit hours must be at the 3000 or 4000 level.
- No more than 3 credits from the HASS Creative Endeavors list may be used to satisfy the HASS Distribution list requirements.
- No more than 3 credits from the HASS Supplemental List may be used to satisfy the HASS Distribution list requirements.

HASS Distribution List

International Study Abroad for Distribution Courses

General Education International transfer credit for study abroad students (students with transfer credit from institutions outside of the US) will be assigned by International Programs and Services (IPS) without regard to specific 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. Michigan Tech courses taken as study-abroad will be applied to distribution list requirements based upon the distribution list the course is on.

Science, Technology, Engineering, Mathematics (STEM) Requirement (16 credits)

All Michigan Tech baccalaureate graduates must take a minimum of 16 credits of science, technology, engineering, mathematics, or computer science. Check with your department or advisor for major-specific requirements. Some programs specify all 16 credits; others may not. For example, a computer science course may be a requirement for some departments but not others.

Note the following restrictions:

1. At least 12 of those credits must be outside the student's major field.
2. Students must complete 4 credits or more in mathematics. See list (link below).
3. Students must complete one laboratory science course. See list (link below).

For curricula that do not specify mathematics and lab science requirements, students can meet these requirements by taking courses listed here: STEM Courses (Math/Lab Science Requirement)
Transfer credit. Students are permitted to transfer courses from other institutions to satisfy these requirements. Students must check with the Michigan Tech Transfer Services Office to find out which courses qualify for transfer from a specific institution before a class is taken off-campus.

Cocurricular Requirement (3 units)
Three Cocurricular Activities 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 or in the overall degree-credit requirement. Repeatable courses may not be repeated for cocurricular general education credit.

As a part of the cocurriculum, 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 cocurricular activity will count toward satisfactory progress for financial aid purposes and toward status as a full-time student. Some cocurricular activities may have lab fees.

Please note that most physical education activities will last for seven and one-half weeks, or one-half semester. A student would need six of these 0.5-semester units to fulfill the 3-semester-unit cocurricular requirement. Some ROTC courses are also approved for cocurricular activity, and a few of these (and a few PE courses) are a full semester in length and count for 1 semester unit. These are identified in the course descriptions list, which is available here: Cocurricular Courses
Students must take 15 credits from the Humanities, Arts, and Social Sciences (HASS) Distribution List with the following limitations:

- 6 credit hours must be at the 3000 or 4000 level.
- No more than 3 credits from the HASS Creative Endeavors list may be used to satisfy the HASS Distribution List requirements.
- No more than 3 credits from the HASS Supplemental list may be used to satisfy the HASS Distribution List requirements.

**International Study Abroad for HASS Courses**

General Education international transfer credit, for students who participate in an international study abroad experience, will be assigned by International Programs and Services (IPS). 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.

Courses marked with an asterisk may be taken during a student’s first year.

### HASS Distribution List

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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<tr>
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<td>Level I-A German Language &amp; Culture*</td>
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<tr>
<td>HU2282</td>
<td>Level I-B German Language &amp; Culture</td>
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<tr>
<td>HU2291</td>
<td>Level I-A Spanish Language &amp; Culture*</td>
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<td>HU2292</td>
<td>Level I-B Spanish Language &amp; Culture</td>
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<td>HU2293</td>
<td>Transitional Level I Spanish Language &amp; Culture*</td>
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<td>HU2324</td>
<td>Introduction to Film*</td>
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<tr>
<td>HU2400</td>
<td>Introduction to Diversity Studies*</td>
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<tr>
<td>HU2501</td>
<td>American Experience in Literature*</td>
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<td>HU2505</td>
<td>Science, Technology &amp; Humanities*</td>
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<td>HU2520</td>
<td>Cultural Diversity in American Literature*</td>
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<td>HU2538</td>
<td>British Experience in Literature*</td>
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<td>HU2540</td>
<td>The Spoken World*</td>
<td>3</td>
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<td>HU2548</td>
<td>Young Adult Literature*</td>
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<tr>
<td>HU2700</td>
<td>Introduction to Philosophy*</td>
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<tr>
<td>HU2701</td>
<td>Logic and Critical Thinking*</td>
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<td>HU2702</td>
<td>Ethical Theory and Moral Problems*</td>
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<td>HU2820</td>
<td>Communication and Culture*</td>
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<td>Language and Mind*</td>
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<td>HU2920</td>
<td>Language and Society*</td>
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<td>HU3110</td>
<td>The Writer's Workshop*</td>
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<td>HU3130</td>
<td>Rhetorical Theory and Criticism</td>
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<td>Reading and Writing</td>
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<td>HU3151</td>
<td>The Rhetoric of Everyday Texts</td>
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<td>Level II-A Chinese Language and Culture</td>
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<td>Level II-B Chinese Language and Culture</td>
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<td>Level III Topics in Chinese Literature and Culture</td>
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<td>HU3241</td>
<td>Level II A Commonly Taught Language &amp; Culture</td>
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<td>Level II B Less Commonly Taught Language &amp; Culture</td>
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<td>HU3253</td>
<td>World Literatures &amp; Cultures</td>
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<td>Communicating Across Cultures</td>
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<td>Topics in German-Speaking Culture</td>
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<td>HU3273</td>
<td>Level II French Composition &amp; Conversation</td>
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<td>Topics in French Literature &amp; Culture</td>
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<td>HU3275</td>
<td>French for Special Purposes</td>
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<td>Level I-C German Language and Culture</td>
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<td>Level II German Composition &amp; Conversation</td>
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<td>HU3284</td>
<td>Topics in German Literature &amp; Culture</td>
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<td>HU3285</td>
<td>German for Special Purposes</td>
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<tr>
<td>HU3291</td>
<td>Level II-A Spanish Language &amp; Culture</td>
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<td>HU3293</td>
<td>Level II-C Spanish Composition &amp; Conversation</td>
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<td>HU3294</td>
<td>Hispanic Literatures and Culture</td>
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<td>HU3295</td>
<td>Level III Advanced Spanish for Specific Literacies</td>
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<tr>
<td>HU3325</td>
<td>Film History and Theory</td>
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<td>HU3326</td>
<td>Topics in World Cinema</td>
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<td>HU3400</td>
<td>Topics in Diversity Studies*</td>
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<td>HU3401</td>
<td>Gender and Culture *</td>
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<td>Medieval Literature &amp; Cultures</td>
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<td>HU3502</td>
<td>World Mythologies</td>
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<td>HU3504</td>
<td>Studies in the Novel</td>
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<td>HU3510</td>
<td>The American Novel</td>
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<td>HU3513</td>
<td>Shakespeare</td>
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<td>HU3517</td>
<td>Literary Theory and Criticism</td>
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<td>Major British Authors</td>
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<td>HU3541</td>
<td>Major American Authors</td>
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<tr>
<td>HU3545</td>
<td>Literature Across Borders*</td>
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<td>HU3554</td>
<td>Science Fiction and Fantasy Literature</td>
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<td>HU3555</td>
<td>Modern and Contemporary British Literature</td>
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<td>HU3556</td>
<td>Modern and Contemporary American Literature</td>
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<tr>
<td>HU3621</td>
<td>Introduction to Journalism</td>
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</tbody>
</table>
HASS Distribution List 2013-14, Page 2 of 3

HASS Creative Endeavors List
No more than 3 credits from the HASS Creative Endeavors list may be used to satisfy the HASS Distribution List requirements.

FA2050  Drawing I*  3
FA2150  Creative Drawing*  3
FA2200  Watermedia I*  3
FA2305  Ceramics I*  3
FA2430  R & D Jazz Band*  1
FA2580  Group Voice*  2
FA2800  Acting I*  3
FA2610  Acting II: Scene Study  3
FA3150  Life Drawing  3
FA3200  Creative Watermedia  3
FA3305  Creative Ceramics  3
FA3333  Sculpture*  3
FA3335  Sculpture II  3
FA3380  Ceramic Sculpture  3
FA3400  Kweerae Symphony Orchestra*  1
FA3401  Wind Symphony*  1
FA3430  Jazz Lab Band*  1
FA3510  Concert Choir*  1
FA3420  Chamber Choir*  1
HU2631  Fundamentals of Photography*  3
HU2632  Fundamentals of Digital Photography*  3
SS3210  Field Archaeology  var
**HASS Supplemental List**

No more than 3 credits from the HASS Supplemental list may be used to satisfy the HASS Distribution List requirements.

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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<td>AF2001</td>
<td>History US Air/Space Power I</td>
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<td>AF2002</td>
<td>History US Air/Space Power II</td>
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<td>AF2010</td>
<td>History US Air/Space Power I (NonAFROTC)</td>
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<td>History US Air/Space Power II (NonAFROTC)</td>
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<td>AF3001</td>
<td>Leadership Studies I</td>
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<tr>
<td>AF3010</td>
<td>Leadership Studies I (NonAFROTC)</td>
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<td>AF4001</td>
<td>National Security Affairs I</td>
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<td>AR4001</td>
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<td>CM3410</td>
<td>Technical Communication for Chemical Engineering</td>
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<td>Communication Contexts</td>
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<td>ENT3961</td>
<td>Ethics in Engineering Design and Implementation</td>
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<td>ENT3962</td>
<td>Enterprise Strategic Leadership</td>
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<td>ENT3962</td>
<td>Communication Strategies</td>
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<td>FA2080</td>
<td>Presentation Skills*</td>
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<td>FA2830</td>
<td>Voice and Articulation*</td>
<td>3</td>
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<td>GE2100</td>
<td>Environmental Geology*</td>
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<td>HU2830</td>
<td>Introduction to Speech Communication*</td>
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<td>HU3120</td>
<td>Technical and Professional Communication</td>
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<td>MGT3100</td>
<td>Leadership Development*</td>
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<td>MGT/SS3650</td>
<td>Intellectual Property Management</td>
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<td>Industrial Organizational Psychology</td>
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<td>SS3640</td>
<td>Selected Topics in Cyber-Law</td>
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<tr>
<td>UN2200</td>
<td>Leadership, Culture, and Technology</td>
<td>3</td>
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<tr>
<td>UN3200</td>
<td>Global Technological Leadership</td>
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</tbody>
</table>
Effective Fall 2013, the HASS requirement will be 12 credits. The following limitations apply:

- 6 credit hours must be at the 3000 or 4000 level.
- No more than 3 credits from the HASS Creative Endeavors list may be used to satisfy the HASS Distribution List requirements.
- No more than 3 credits from the HASS Supplemental list may be used to satisfy the HASS Distribution List requirements.

International Study Abroad for HASS Courses

General Education international transfer credit, for students who participate in an international study abroad experience, will be assigned by International Programs and Services (IPS). 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.

Courses marked with an asterisk may be taken during a student’s first year.

### HASS Distribution List

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<td>Archaeology of Industry</td>
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<td>Reading the Landscape</td>
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<td>SS3250</td>
<td>Human Origins and Evolution</td>
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<td>SS3260</td>
<td>Latin American Cultural History</td>
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<td>Archaeology of the African Diaspora</td>
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<td>Environmental Problems</td>
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<td>SS3313</td>
<td>Sustainable Science Policy &amp; Assessment</td>
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<td>SS3315</td>
<td>Population and Environment</td>
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<td>SS3410</td>
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<td>SS3505</td>
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<tr>
<td>SS3510</td>
<td>History of American Technology</td>
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<td>SS3515</td>
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<td>SS3520</td>
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<tr>
<td>SS3530</td>
<td>The Automobile in America*</td>
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<tr>
<td>SS3540</td>
<td>History of Michigan</td>
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<tr>
<td>SS3541</td>
<td>The Copper Country*</td>
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<tr>
<td>SS3552</td>
<td>Renaissance and Reformation</td>
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<tr>
<td>SS3560</td>
<td>History of England I</td>
<td>3</td>
</tr>
<tr>
<td>SS3561</td>
<td>History of England II</td>
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<td>SS3570</td>
<td>History of Canada</td>
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<td>SS3580</td>
<td>Technology &amp; Western Civilization</td>
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<td>Civil Rights &amp; Civil Liberties</td>
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<td>SS3710</td>
<td>Social Problems</td>
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<td>Social Inequality</td>
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<td>SS3800</td>
<td>Energy Technology and Policy</td>
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<td>SS3801</td>
<td>Science, Technology, &amp; Society</td>
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<tr>
<td>SS3820</td>
<td>Ethical, Legal, &amp; Societal Implications of Nanotechnology</td>
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<td>SS3910</td>
<td>Histories and Cultures</td>
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</tr>
<tr>
<td>SS3920</td>
<td>Topics in Anthropology/Archaeology</td>
<td>3</td>
</tr>
<tr>
<td>SS3950</td>
<td>Topics in American History</td>
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<tr>
<td>SS3951</td>
<td>Topics in European History</td>
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<tr>
<td>SS3952</td>
<td>Topics in World History</td>
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<td>SS3960</td>
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<td>SS3990</td>
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<td>SS4001</td>
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<tr>
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<td>American Indian Political Issues</td>
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<td>SS4200</td>
<td>Environmental Anthropology</td>
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<td>SS4210</td>
<td>Global Change in Culture and Society Since 1400</td>
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<tr>
<td>SS4700</td>
<td>Communities and Research</td>
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<tr>
<td>UN3404</td>
<td>Cultural Immersion</td>
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<tr>
<td>UN3900</td>
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**HAAS Creative Endeavors List**

No more than 3 credits from the HASS Creative Endeavors list may be used to satisfy the HASS Distribution List requirements.

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
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<tbody>
<tr>
<td>FA2050</td>
<td>Drawing I*</td>
<td>3</td>
</tr>
<tr>
<td>FA2150</td>
<td>Creative Drawing*</td>
<td>3</td>
</tr>
<tr>
<td>FA2200</td>
<td>Watermedia I*</td>
<td>3</td>
</tr>
<tr>
<td>FA2305</td>
<td>Ceramics I*</td>
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</tr>
<tr>
<td>FA2430</td>
<td>R &amp; D Jazz Band*</td>
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</tr>
<tr>
<td>FA2590</td>
<td>Group Voice*</td>
<td>2</td>
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<tr>
<td>FA2600</td>
<td>Acting I*</td>
<td>3</td>
</tr>
<tr>
<td>FA2610</td>
<td>Acting II: Scene Study</td>
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<tr>
<td>FA3150</td>
<td>Life Drawing</td>
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<tr>
<td>FA3200</td>
<td>Creative Watermedia</td>
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<tr>
<td>FA3305</td>
<td>Creative Ceramics</td>
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<tr>
<td>FA3333</td>
<td>Sculpture*</td>
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<tr>
<td>FA3335</td>
<td>Sculpture II</td>
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<tr>
<td>FA3360</td>
<td>Ceramic Sculpture</td>
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<td>FA3400</td>
<td>Keweenaw Symphony Orchestra*</td>
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<tr>
<td>FA3401</td>
<td>Wind Symphony*</td>
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<tr>
<td>FA3430</td>
<td>Jazz Lab Band*</td>
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<tr>
<td>FA3510</td>
<td>Concert Choir*</td>
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<td>FA3580</td>
<td>Chamber Choir*</td>
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<tr>
<td>HU2631</td>
<td>Fundamentals of Photography*</td>
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<td>HU2632</td>
<td>Fundamentals of Digital Photography*</td>
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<tr>
<td>SS3210</td>
<td>Field Archaeology</td>
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**HASS Supplemental List**

No more than 3 credits from the HASS Supplemental list may be used to satisfy the HASS Distribution List requirements.

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<tr>
<th>Course Code</th>
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<td>History US Air/Space Power I</td>
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<tr>
<td>AF2002</td>
<td>History US Air/Space Power II</td>
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<td>AF2010</td>
<td>History US Air/Space Power I (NonAFROTC)</td>
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<td>AF2020</td>
<td>History US Air/Space Power II (NonAFROTC)</td>
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<tr>
<td>AF3001</td>
<td>Leadership Studies I</td>
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</tr>
<tr>
<td>AF3010</td>
<td>Leadership Studies I (NonAFROTC)</td>
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<tr>
<td>AF4001</td>
<td>National Security Affairs I</td>
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<tr>
<td>AF4010</td>
<td>National Security Affairs I (NonAFROTC)</td>
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<td>AR4001</td>
<td>Developing Adaptive Leaders</td>
<td>var</td>
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<tr>
<td>CM3410</td>
<td>Technical Communication for Chemical Engineering</td>
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<tr>
<td>ED3510</td>
<td>Communicating Science I</td>
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<tr>
<td>ED3511</td>
<td>Communicating Science II</td>
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<td>ENT2961</td>
<td>Teaming in the Enterprise</td>
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<td>ENT2962</td>
<td>Communication Contexts</td>
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<tr>
<td>ENT3958</td>
<td>Ethics in Engineering Design and Implementation</td>
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<tr>
<td>ENT3961</td>
<td>Enterprise Strategic Leadership</td>
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<tr>
<td>ENT3962</td>
<td>Communication Strategies</td>
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<tr>
<td>FA2080</td>
<td>Presentation Skills*</td>
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<tr>
<td>FA2830</td>
<td>Voice and Articulation*</td>
<td>3</td>
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<tr>
<td>GE2100</td>
<td>Environmental Geology*</td>
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<tr>
<td>HU2830</td>
<td>Introduction to Speech Communication*</td>
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<td>HU3120</td>
<td>Technical and Professional Communication</td>
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<tr>
<td>MGT3100</td>
<td>Leadership Development*</td>
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<tr>
<td>MGT/SS3650</td>
<td>Intellectual Property Management</td>
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<td>PSY3700</td>
<td>Industrial Organizational Psychology</td>
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<tr>
<td>SS3640</td>
<td>Selected Topics in Cyber-Law</td>
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<td>Leadership, Culture, and Technology</td>
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<tr>
<td>UN3200</td>
<td>Global Technological Leadership</td>
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Science, Technology, Engineering and Mathematics (STEM) Courses
2013-2014 Academic Year

Students must take a minimum of 16 credits of Science, Technology, Engineering, and Mathematics (STEM) with the following limitations:* 
· Students must complete one laboratory science course, including both the lab and the corresponding lecture.
· Students must complete a minimum of 4 credit hours in mathematics at the 1000-level or higher
· At least 12 STEM credits must be outside the student’s major field of study.

*Some programs specify all 16 credits; others do not. For example, a computer science course may be required for some departments, but not others. Students should check with their academic advisor for specific requirements.

· Lab Science (1 course)

For curricula that do not specify the lab science requirement, students can meet the requirement by taking one of the following:

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<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
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<td>BL1010</td>
<td>General Biology I</td>
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<tr>
<td>BL1020</td>
<td>General Biology II</td>
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<tr>
<td>BL1040</td>
<td>Principles of Biology</td>
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<tr>
<td>BL2011</td>
<td>Anatomy &amp; Physiology Lab I (plus BL2010)</td>
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<tr>
<td>BL2160</td>
<td>Botany</td>
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<tr>
<td>BL2170</td>
<td>Zoology</td>
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<td>BL3310</td>
<td>Environmental Microbiology</td>
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<tr>
<td>BL3400</td>
<td>Principles of Ecology</td>
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<tr>
<td>BL4440</td>
<td>Fish Biology</td>
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<tr>
<td>CH1151</td>
<td>University Chemistry Lab I (plus CH1150)</td>
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<tr>
<td>CH1112</td>
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<td>CH1122</td>
<td>University Chemistry – Studio Lab II</td>
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<td>CH1161</td>
<td>University Chemistry Lab II (plus CH1160)</td>
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<tr>
<td>EH3700</td>
<td>Lifetime Fitness</td>
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<tr>
<td>FW1035</td>
<td>Wood Anatomy and Properties</td>
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<tr>
<td>FW2010</td>
<td>Vegetation of North America</td>
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<td>FW3020</td>
<td>Forest and Landscape Ecology</td>
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<tr>
<td>FW3330</td>
<td>Soil Science</td>
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<tr>
<td>FW3610</td>
<td>Ornithology</td>
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<tr>
<td>FW3621</td>
<td>Field Ornithology Techniques</td>
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<td>FW4220</td>
<td>Wetlands</td>
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<tr>
<td>FW4240</td>
<td>Mammalogy</td>
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<td>GE2000</td>
<td>Earth Materials I: Mineralogy</td>
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<td>GE2500</td>
<td>Introduction to Oceanography</td>
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<td>Earth History and Paleoclimatology</td>
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<td>Geology and Ecology of Reefs</td>
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<td>Soil Genesis and Crops</td>
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<td>Geohydrology</td>
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<td>Geomorphology and Glacial Geology</td>
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<td>Physics by Inquiry I (plus PH2100)</td>
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<tr>
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<td>College Physics I Laboratory (plus PH1110)</td>
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<td>Introduction to Experimental Physics I (plus PH1160)</td>
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<td>Physics by Inquiry II (plus PH2200 or PH1210 or PH1240)</td>
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<td>Introductory Astronomy Laboratory (plus PH1600)</td>
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<td>PH1190</td>
<td>The Physics Behind Music Lab (plus PH1090)</td>
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<td>Physics by Inquiry I (plus PH2100)</td>
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<tr>
<td>PH1111</td>
<td>College Physics I Laboratory (plus PH1110)</td>
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<td>Applied College Physics I Laboratory (plus PH1140)</td>
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<td>Physics by Inquiry II (plus PH2200 or PH1210 or PH1240)</td>
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<td>PH1610</td>
<td>Introductory Astronomy Laboratory (plus PH1600)</td>
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<td>Archaeological Sciences</td>
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</table>

· Mathematics (4 credits)

For curricula that do not specify the mathematics requirement, students can meet the requirement by taking the following:

· 4 credits or more of any Mathematics (MA) course, 1000-level or higher, except MA4945.

· Other STEM Courses

For curricula that do not specify the remaining STEM requirement, students can meet the requirement by taking the following:

Any course listed under the lab science requirement that is not being used to satisfy the lab science requirement or by taking one of the following courses:

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<tr>
<td>BUS2300</td>
<td>Quantitative Problem Solving (previously BA2110)</td>
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<tr>
<td>EC4200</td>
<td>Econometrics</td>
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<tr>
<td>EH1500</td>
<td>Foundations of Kinesiology</td>
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<td>EH2200</td>
<td>Human Reproductive Health and Development</td>
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<tr>
<td>FA2701</td>
<td>Drafting for the Entertainment Industry</td>
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<tr>
<td>FA4701</td>
<td>Stage Mechanics and Rigging</td>
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<tr>
<td>FA4740</td>
<td>Transducer Theory</td>
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<td>MIS2100</td>
<td>Intro to Business Programming (previously BA2200)</td>
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<td>Statistics for Social and Behavioral Sciences</td>
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Any course 1000 level or higher in the following disciplines:

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<td>CS1010, CS1020, CS1030, CS1040, CS1050</td>
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<td>Geology</td>
<td>GE1010, GE1020, GE1030, GE1040, GE1050, GE1060</td>
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<td>Mathematics</td>
<td>MA1010, MA1020, MA1030, MA1040, MA1050, MA1060</td>
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<tr>
<td>Physics</td>
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<tr>
<td>Technology</td>
<td>CMG1010, CMG1020, CMG1030, CMG1040, CMG1050</td>
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Except for the following courses which may not be used to satisfy STEM requirements because they are included on the HASS list:

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<td>CM5410, ENT2961, ENT2962, ENT3958, ENT3961, EN1962,</td>
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<td>EN4954, FW3110, FW5760, GE2100, GE4630, MA4945</td>
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*Except for the following ENT courses which may not be used to satisfy STEM requirements:

<table>
<thead>
<tr>
<th>Course Code</th>
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<tbody>
<tr>
<td>EN1960, EN3954, EN3963, EN3964, EN3971, EN4951</td>
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</table>
**Co-curricular Courses**

**2013-2014 Academic Year**

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 part of the co-curriculum, titles of courses 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.

<table>
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<th>CO-CURRICULAR COURSES</th>
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*PE0210 may only be repeated once for general education co-curricular credit if topics are different.*
**Accounting**

**ACC 2000 - 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

**ACC 2100 - 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

**Pre-Requisite(s):** ACC 2000 or BA 2300 or BA 2330

**ACC 3000 - 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

**Pre-Requisite(s):** ACC 2100 or BA 2310 or BA 2340

**ACC 3100 - Accounting Theory/Practice II**
A continuation of ACC 3000 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

**Pre-Requisite(s):** (ACC 3000 and FIN 3000(C)) or (BA 3300 and BA 3400)

**ACC 3500 - 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

**Pre-Requisite(s):** ACC 2100 or BA 2310 or BA 2340

**ACC 3600 - 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

**Pre-Requisite(s):** ACC 2100 or BA 2310 or BA 2340

**ACC 3600 - Foundations of Taxation**

**ACC 3610 - Advanced Accounting**
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:** Fall

**Pre-Requisite(s):** ACC 3100 or BA 3310

**ACC 4200 - Advanced Accounting**
The theory and practice of financial accounting and reporting pertaining to business combinations and consolidated financial statements, accounting for partnerships, and related business forms, foreign currency transactions, and financial statement translations, and other advanced accounting topics.

*Credits: 3.0*

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

**Semesters Offered:** Fall

**Pre-Requisite(s):** ACC 3100 or BA 3310

**ACC 4500 - 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

**Pre-Requisite(s):** ACC 3500 or BA 3320

**ACC 4600 - Advanced Tax Topics**
Continuation of ACC3600. 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

**Pre-Requisite(s):** ACC 3600 or BA 4310

**ACC 4700 - Governmental and Not-for-Profit Accounting**
An in-depth study of the accounting principles and financial reporting unique to the governmental and not-for-profit sectors of the U.S. economy.

*Credits: 3.0*

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

**Semesters Offered:** Spring

**Pre-Requisite(s):** ACC 3100 or BA 3310

**ACC 4800 - 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

**Pre-Requisite(s):** ACC 2100 or BA 2310 or BA 2340

**ACC 4990 - Special Topics in Accounting**
Examines current issues in Accounting and other topics of interest to faculty and students in greater depth.

*Credits: variable to 3.0; Repeatable to a Max of 6*

**Semesters Offered:** On Demand

**Restrictions:** Permission of instructor required

**Pre-Requisite(s):** ACC 3310 or BA 3310

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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. May be used once as a general education co-curricular course. Sports physical required prior to start of class (contact instructor for details).
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: 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; 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. May be used once as a general education co-curricular course. Non-cadets are required to provide a uniform cleaning deposit and purchase some non-returnable uniform items.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall
Restrictions: Permission of instructor required

AF 0340 - Field Training
A rigorous program of physical conditioning, team activities, and survival training. Offered the summer semester after acceptance into the Field Training program. Course completed off campus.
Credits: 1.0; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Summer
Restrictions: Permission of instructor required

AF 1001 - Foundations of US Air Force I
Introduces students to the USAF and ROTC. Topics include Air Force mission and organization, officerhood, 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, officerhood, 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: Fall

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: Spring

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

AF 2010 - History of US Air And Space Power I for Non-AFROTC Students
For non-AFROTC students. AFROTC cadets should enroll in AF2001.
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: (0-1-0)
Semesters Offered: Fall
Restrictions: Permission of instructor required

AF 2020 - History of US Air and Space Power II for Non-AFROTC Students
For non-AFROTC students. AFROTC students should enroll in AF2002.
This course examines the history of United State air and 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: (0-1-0)
Semesters Offered: Spring
Restrictions: Permission of instructor required

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: (0-2-3)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore

AF 3002 - Leadership Studies II
Study of leadership in civilian and military institutions. Topics include officerhood, 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: (0-2-2)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore

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AF 3010 - Leadership Studies I for Non-AFROTC Students
For non-AFROTC students. AFROTC cadets should enroll in AF3001. 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, self-evaluation of leadership traits, and experiential exercises.
Cred:
Semesters Offered: Fall
Restrictions: Permission of instructor required; May not be enrolled in one of the following Class(es): Freshman

AF 3020 - Leadership Studies II for Non-AFROTC Students
For non-AFROTC students. AFROTC cadets should enroll in AF3002. 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.
Cred: 3.0
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore

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.
Cred: 3.0
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore

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.
Cred: 3.0
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore

AF 4010 - National Security Affairs I - for Non-AFROTC Students
For non-AFROTC students. AFROTC cadets should enroll in AF4001. 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.
Cred: 3.0
Semesters Offered: Fall
Restrictions: Permission of instructor required; May not be enrolled in one of the following Class(es): Freshman, Sophomore

AF 4020 - National Security Affairs II - for Non-AFROTC Students
For non-AFROTC students. AFROTC cadets should enroll in AF4002. 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.
Cred: 3.0
Semesters Offered: Spring
Restrictions: Permission of instructor required; May not be enrolled in one of the following Class(es): Freshman, Sophomore

Army ROTC

AR 0340 - Internship in Advanced Military Leadership
A rigorous program of physical conditioning, leadership development, and team building training. Offered the summer semester after completion of the Cadets junior year of college. Course completed off campus.
Cred: 3.0; Graded Pass/Fail Only
Semesters Offered: Summer
Restrictions: Permission of department required

AR 1001 - Foundations in Officerhip
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, officerhip, and the Army profession.
Cred: 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.
Cred: 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.
Cred: 1.0
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, snowshoeing, individual and squad level tactics, techniques and procedures.
Cred: 1.0
Semesters Offered: Spring

AR 2001 - Indiv. 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.
Cred: 1.0
Semesters Offered: Fall
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: (0-0-3)
Semesters Offered: Spring
Co-Requirements: AR 3002
Pre-Requirements: AR 3011

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 be used once as a general education co-curricular course.
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-Requirements: 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 be used once as a general education co-curricular course.
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-Requirements: 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 3775 - U.S. Military History for the Professional Officers
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: (0-3-0)
Semesters Offered: Summer
Restrictions: Permission of department required

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, Spring
Co-Requirements: AR 4011
Pre-Requirements: 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-Requirements: AR 4012
Pre-Requirements: 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 4004

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

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

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; Graded Pass/Fail Only
Lec-Rec-Lab: (1-0-0)
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 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: Spring
Pre-Requisite(s): MA 1135 or MA 1160 or MA 1161

BE 2400 - Cellular and Molecular Biology
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 Class(es): Senior
Pre-Requisite(s): CH 1150 and MA 1160 or MA 1161

BE 2700 - Biomedical Signals & Systems
Introduces the origin, processing and interpretation of biological signals. Mathematical modeling techniques used in the analysis of linear systems. Topics include: Fourier, Laplace and z-transforms, signal comparison techniques, power spectrum analysis, 2-dimensional signals, transfer functions, convolution, and simulations.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Pre-Requisite(s): CH 1150 or CH 1112 and PH 2100 and MA 2160 and ENG 1102

BE 2800 - Biomaterials I: Fundamental Materials Science and Engineering
Introduction to the fundamental materials science principles and different classes of biomaterials (metals, ceramics, polymers and their composites), and some practical professional issues concerning the field of biomaterials.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Pre-Requisite(s): BE 2400

BE 3000 - Biomechanics I: Statics and Dynamics
Course provides overview of two and three-dimensional force and structure systems and their applicability to human body. Course topics will include principle of equilibrium, concept of free-body diagram, moment of inertia, centroids. Kinematics and equations of motion, principle of energy, work and momentum. Course materials tailored for biological applications, particularly for applications at human organ level.
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): BE 2400 and MA 2321 or MA 2320 or MA 2330 and (MA 3521 or MA 3520 or MA 3530) and BL 2010

BE 3350 - Biomechanics II: Soft Tissue and Bio-Fluid Mechanics
This course teaches basic principles of mechanics that are closely related to human soft tissue and bio-flow, particularly, at the human organ level. Emphases are given to both engineering fundamentals and biomedical applications.
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): BE 3300

BE 3400 - Experimental Techniques in Biomedical Engineering
An introduction to the experimental techniques used in biomedical engineering, technical report writing, and record keeping.
Credits: 2.0
Lec-Rec-Lab: (0-1-2)
Semesters Offered: Fall
Pre-Requisite(s): BE 2800

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): BE 2400 and MY 2100 and MEEM 2150(C) and (BE 2600 or BE 2700(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(C) and BL 2021(C) and BE 2600

BE 3700 - Biomedical Instrumentation
Introductory theory of measurement and analysis from biological systems. Covers the principles and use of transducers, data recording and analysis systems and signal processing techniques. Example measurements include life science research and clinical measurements such as the vital signs.
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
Co-Requisite(s): BE 3701
Pre-Requisite(s): EE 3010 and PH 2200 and BL 2020(C)

BE 3701 - Biomedical Instrumentation Lab
Laboratory exercises to demonstrate basic instrumentation principles and biomedical measurements. Students will learn how to make non-invasive measurements on themselves and how to evaluate measurement instrumentation. Course will coincide with BE3700 lectures.
Credits: 1.0
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Co-Requisite(s): BE 3700

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. Credit may not be received for both BE3750 and MEEM4180.
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
Pre-Requisite(s): BL 2010 and (MEEM 2150 or ENG 2120) and BE 2600

BE 3800 - Biomaterials II: Properties and Biological Interactions
Biomaterials properties including structure-function relationships (materials composition and properties), protein/cell materials interactions, characterization methods, and handling and processing considerations.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Pre-Requisite(s): BE 2700(C) and BE 2800

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 adaptation 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: Fall - Offered alternate years beginning with the 2009-2010 academic year
Pre-Requisite(s): BE 3750 or MEEM 4150 and (BE 2400 or BL 1040)

BE 4200 - Cellular and Molecular Biology 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: Fall - Offered alternate years beginning with the 2009-2010 academic year
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): BE 2400

BE 4250 - Biomedical Optics
Light plays a significant role in modern clinical diagnostics and in the clinical treatment of disease. Examples include non-invasive surgery, optical biopsy, and cancer therapy. This course will focus on the study of how light propagates through biological tissue.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Pre-Requisite(s): (MA 2320 or MA 2321 or MA 2330) and (MA 3520 or MA 3521 or MA 3530 or MA 3560) and MA 3160

BE 4300 - 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: Spring - Offered alternate years beginning with the 2009-2010 academic year
Pre-Requisite(s): BE 3500

BE 4510 - Cardiovascular Engineering
Fundamental cardiovascular pathology and the biomedical engineering approaches being developed and used toward problems resulting in significant cardiovascular deficiency such as myocardial infarction, chronic kidney disease, atherosclerosis, and heart valve disease.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2010-2011 academic year
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): BL 2020 and BE 2400

BE 4610 - Biological Microscopy for Engineers
The goal of the course is to inform students of the different imaging techniques available and to help them determine which imaging technique(s) would be most useful for a particular biomedical engineering application.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall - Offered alternate years beginning with the 2011-2012 academic year
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
BE 4660 - Active Implantable Devices
Implantable devices that are actively delivering therapy and acting as monitoring tools will be covered. Emphasis will be on the technology and its application. Devices include electrical stimulators, pumps & diagnostic instruments.
Credits: 3.0  
Lec-Rec-Lab: (3-0-0)  
Semesters Offered: Fall - Offered alternate years beginning with the 2010-2011 academic year  
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.
Credits: 3.0  
Lec-Rec-Lab: (3-0-0)  
Semesters Offered: Fall - Offered alternate years beginning with the 2009-2010 academic year  
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore  
Pre-Requisite(s): BE 3600

BE 4770 - Biomedical Microcontrollers
The focus of this course is to provide biomedical engineering students the necessary skills to develop microcontroller-based devices. Provides basic knowledge on computer programming languages, microcontrollers, digital circuits, and microcontroller development kits. Students will design and fabricate a microcontroller-based device using a microcontroller development kit for a specific biomedical application.
Credits: 3.0  
Lec-Rec-Lab: (1-0-2)  
Semesters Offered: Spring - Offered alternate years beginning with the 2010-2011 academic year  
Pre-Requisite(s): BE 3600

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: Spring - Offered alternate years beginning with the 2010-2011 academic year  
Pre-Requisite(s): BE 3600

BE 4880 - Principles and Analysis of Cellular Processes
Course includes an overview of organic chemistry, biochemical principles of DNA and protein structure, and analytical methods including microarray chips, fluorescent methods of detection, and immunoassays as well as iso-10,993 procedures for the evaluation of biological response to medical devices.
Credits: 3.0  
Lec-Rec-Lab: (3-0-0)  
Semesters Offered: Fall - Offered alternate years beginning with the 2010-2011 academic year  
Pre-Requisite(s): BE 3600

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

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 or MEEM 4180)

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: 2.0  
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  
Restrictions: Permission of instructor required

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: Fall - Offered alternate years beginning with the 2010-2011 academic year  
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore  
Pre-Requisite(s): BE 2400 and BL 2020

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): Clinical Laboratory Science, Biological Sciences

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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, Summer
Restrictions: Must be enrolled in one of the following Major(s): Clinical Laboratory Science, Biological Sciences
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, Summer
Restrictions: May not be enrolled in one of the following Major(s): Clinical Laboratory Science, Biological Sciences

BL 1580 - Introduction to Biological Sciences
Introduction to fields and career opportunities in the biological sciences.
Credits: 1.0
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Major(s): Biological Sciences

BL 1590 - Introduction to the Health Professions
Introduction to various careers in the health professions. Discusses required course work, entrance exams, and other requirements for entry to the various fields. Guest lecturers include representatives of many health areas.
Credits: 1.0
Lec-Rec-Lab: (1-0-0)
Semesters Offered: Fall

BL 1600 - Introduction to Clinical Laboratory Science
Introduction to subspecialties, the clinical practicum, career opportunities, and current issues in clinical laboratory science.
Credits: 1.0
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Fall

BL 1710 - Medical Terminology
Autotutorial course covers the fundamentals of medical terminology, including 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 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, Summer
Pre-Requisite(s): CH 1000 or (CH 1150 and CH 1151)

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, Summer
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 embryology, muscle and skeletal anatomy, and neuroanatomy. Explores the physiology 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
Pre-Requisite(s): BL 1020 or BE 2400 and CH 1112 or (CH 1150 and CH 1151)

BL 2101 - Principles of Biochemistry Lab
The laboratory to accompany BL2100. 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: 3.0
Lec-Rec-Lab: (3-0-3)
Semesters Offered: Spring
Pre-Requisite(s): BL 2100(C)

BL 2110 - Medical Terminology Lab
The laboratory to accompany BL2110, Medical Terminology. Focuses on laboratory exercises and related assignments.
Credits: 1.0
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Fall

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, Summer
Pre-Requisite(s): (BL 1020 or BL 1040 or BE 2400) 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 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): Clinical Laboratory Science, Biological Sciences; May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): BL 2200 or BL 1040

BL 2310 - Environmental Microbiology
Study of the form, function, and diversity of insects along with their relationship to humans as pests and disease vectors and their role in the natural world.
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
Pre-Requisite(s): BL 1010 or BL 1040

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

BL 3010 - General Entomology
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 3100 - 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 3220 - Medical Mycology and Virology
Study of clinically important fungi and viruses.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Major(s): Clinical Laboratory Science, Biological Sciences; May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): BL 3210

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 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, Summer
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): BL 3210

BL 3310 - 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: (2-0-3)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Major(s): Biochem & Molec Biology-Bio Sc, Clinical Laboratory Science, Bioinformatics, Biological Sciences; 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: Fall, Summer
Restrictions: Must be enrolled in one of the following Major(s): Bioinformatics, Biochem & Molec Biology-Bio Sc, Pharmaceutical Chemistry, Clinical Laboratory Science, Biomedical Engineering, Biological Sciences; May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): BL 1020 or BL 1040 or BL 2020 or BE 2400

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): Clinical Laboratory Science, Biological Sciences; May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): BL 1710 and BL 2410

BL 3970 - Current Health Issues
Current topics relevant to human health, with emphasis on health maintenance and disease prevention and the role of government in these matters. Topics include: tobacco use and poor diet/physical inactivity, infectious disease, mental and behavioral health, environmental health issues, and health care, including health insurance and models of universal health coverage.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring, Summer
Restrictions: May not be enrolled in one of the following Class(es): Freshman

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 - Research 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): Biological Sciences, Clinical Laboratory Science, Bioinformatics

BL 4002 - Human Genetics
Biochemical genetics and associated human Mendelian disorders with emphasis on processes of pathophysiology and treatment.
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 2100 and BL 2200

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: Fall, Summer
Pre-Requisite(s): (BL 1020 or BL 1040) and (BL 2100 and CH 2410 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, Summer
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, Summer
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 4033 - Pollination Biology
A study of the coevolutionary relationships of plants and their pollinators. Topics will include floral design and function, floral advertisements and rewards, adaptations of flowers for pollination by animals of different taxa as well as abiotic pollination, floral ecology, and the pollination of crops and the global pollination crisis.
Credits: 3.0
Lec-Rec-Lab: (1-2-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2012-2013 academic year
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): BL 1010 or BL 1040 or BL 2160

BL 4034 - Community Ecology and Evolutionary Dynamics
This is an advanced course that looks at the study of ecology and evolutionary biology at the community level: how populations interact with the abiotic environment and each other to determine patterns of diversity, distribution, and abundance of plants and animals.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall - Offered alternate years beginning with the 2014-2015 academic year
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): BL 3400 and BL 3190
BL 4035 - Bioimaging
Current concepts in light and electron microscopy and scanning probe techniques. Theory and practice of fluorescence (including confocal and multi-photon), atomic force, scanning and transmission electron, and video microscopy as applied to biological specimens with emphasis on sample preparation. Half semester course.

Credits: 2.0
Lec-Rec-Lab: (0-4-0)
Semesters Offered: Fall - Offered alternate years beginning with the 2010-2011 academic year
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior

BL 4036 - Ecology and Evolution of Interactions Between Plants and Insects
Plants and insects have played major roles in influencing each others evolutionary diversification. We will examine the ecology and evolution of plant-insect interactions in basic and applied contexts. A solid foundation of tools in ecology and evolution will be established and class will include lectures and interactive discussions from readings of the primary literature.

Credits: 3.0
Lec-Rec-Lab: (3-0-6)
Semesters Offered: Fall - Offered alternate years beginning with the 2013-2014 academic year
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): BL 3400 and BL 3190

BL 4038 - Scanning Electron Microscopy of Biological Specimens
Hands-on training in operation of the scanning electron microscope (SEM). Students prepare biological specimens of their choice for observation. Successful completion of course is prerequisite to becoming a certified SEM operator in the ACMAL. Half semester course.

Credits: 2.0
Lec-Rec-Lab: (0-2-6)
Semesters Offered: Spring - Offered alternate years beginning with the 2010-2011 academic year
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): BL 4035

BL 4042 - Scanning Electron Microscopy of Biological Specimens
Hands-on training in operation of the scanning electron microscope (SEM). Students prepare biological specimens of their choice for observation. Successful completion of course is prerequisite to becoming a certified SEM operator in the ACMAL. Half semester course.

Credits: 2.0
Lec-Rec-Lab: (0-2-6)
Semesters Offered: Fall - Offered alternate years beginning with the 2010-2011 academic year
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior
Co-Requisite(s): BL 4035

BL 4040 - 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: (3-0-6)
Semesters Offered: Spring - Offered alternate years beginning with the 2005-2006 academic year
Pre-Requisite(s): BL 2160 and CH 2420

BL 4045 - Plant-Microbe Interactions
Interactions between plants and microorganisms in the environment. Topics include microbial virulence, signaling, gene expression, beneficial interactions and disease resistance in plants. Laboratory will focus on plant biochemical and microbological methods as they relate to environmental problems.

Credits: 3.0
Lec-Rec-Lab: (2-0-2)
Semesters Offered: Fall - Offered alternate years beginning with the 2012-2013 academic year
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): BL 2200

BL 4050 - 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 4070 - Bioimaging
Current concepts in light and electron microscopy and scanning probe techniques. Theory and practice of fluorescence (including confocal and multi-photon), atomic force, scanning and transmission electron, and video microscopy as applied to biological specimens with emphasis on sample preparation. Half semester course.

Credits: 2.0
Lec-Rec-Lab: (0-4-0)
Semesters Offered: Fall - Offered alternate years beginning with the 2010-2011 academic year
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior

BL 4076 - Transmission Electron Microscopy of Biological Specimens
Hands-on training in operation of the transmission electron microscope (TEM). Students prepare biological specimens of their choice for observation. Successful completion of course is prerequisite to becoming a certified TEM operator in ACMAL. Half semester course.

Credits: 2.0
Lec-Rec-Lab: (0-2-6)
Semesters Offered: Spring - Offered alternate years beginning with the 2010-2011 academic year
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior
Pre-Requisite(s): BL 4035

BL 4090 - Environmental Remediation and Toxicology
Toxicology of major environmental pollutants, their dose-response relationships and fundamentals of environmental remediation. Topics include physical, chemical, and biological remediation methods and effect of environmental toxins on biological systems. Laboratory will involve the application of chemical and biological remediation techniques.

Credits: 3.0
Lec-Rec-Lab: (2-0-2)
Semesters Offered: Fall - Offered alternate years beginning with the 2011-2012 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 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, Summer

BL 4120 - Environmental Remediation and Toxicology
Toxicology of major environmental pollutants, their dose-response relationships and fundamentals of environmental remediation. Topics include physical, chemical, and biological remediation methods and effect of environmental toxins on biological systems. Laboratory will involve the application of chemical and biological remediation techniques.

Credits: 3.0
Lec-Rec-Lab: (2-0-2)
Semesters Offered: Fall - Offered alternate years beginning with the 2011-2012 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 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: (3-0-6)
Semesters Offered: Spring - Offered alternate years beginning with the 2005-2006 academic year
Pre-Requisite(s): BL 2160 and CH 2420

BL 4145 - Plant-Microbe Interactions
Interactions between plants and microorganisms in the environment. Topics include microbial virulence, signaling, gene expression, beneficial interactions and disease resistance in plants. Laboratory will focus on plant biochemical and microbological methods as they relate to environmental problems.

Credits: 3.0
Lec-Rec-Lab: (2-0-2)
Semesters Offered: Fall - Offered alternate years beginning with the 2012-2013 academic year
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): BL 2200

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 4370 - Cell Biology
Celebration of the commonalities of life as exhibited in the basic building block of organisms - the cell. Course topics include details of basic genetic mechanisms, cell structure and function, and an examination of cells in their social context.

Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): BL 2200 and CH 2420
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 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

The study of biological, physical, and chemical processes of freshwater systems using a watershed perspective. Movement of nutrients/organisms from land, via streams/rivers, into lakes will be studied, with emphasis on field work in local lakes/streems.

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 1122 or (CH 1160 and CH 1161)

BL 4455 - Research Methods in Aquatic Ecology

This field and laboratory based course is designed for advanced undergraduate students. Guided by ecological, physiological, and evolutionary theory, we will explore and quantitatively sample flora and fauna, ecosystem processes, and habitat in streams and lakes using traditional and current techniques.

Credits: 2.0
Lec-Rec-Lab: (0-2-4)
Semesters Offered: Fall - Offered alternate years beginning with the 2011-2012 academic year
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): BL 4450 and (BL 4450 or FW 4220 or ENVE 4505)

BL 4461 - Ecosystem Ecology

Study of processes in aquatic and terrestrial ecosystems, including energy flow, ecosystem production, and nutrient cycling. We will explore these processes through a historical overview of influential research programs and regional to global case studies.

Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2011-2012 academic year
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): BL 3400 and CH 1122 or (CH 1160 and CH 1161)

BL 4465 - Biological Oceanography

An overview of ocean environments and marine life. Topics include: trophic level interactions, nutrient cycling, ecology of plankton, invertebrates, fish, mammal and bird resources, and human influences on marine ecosystems. Will cover basic water chemistry and light in oceans.

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): BL 1010 or BL 1040 or BL 3070

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): BL 1010 or BL 1040 or MA 1135 or MA 1160 or MA 1161

BL 4510 - Senior Capstone Experience

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, Biochem & Molec Biology-Bio Sc, Bioinformatics; Must be enrolled in one of the following Class(es): Freshman, Sophomore, Junior
Pre-Requisite(s): BL 4000(C) or BL 4001(C) or BL 4995(C)

BL 4530 - Senior Research Capstone Experience

Reading, interpreting, and integrating information from the primary literature and research project data. Emphasizes oral and written presentations as well as peer review.

Credits: 1.0
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Major(s): Biological Sciences, Biochem & Molec Biology-Bio Sc, Bioinformatics; Must be enrolled in one of the following Class(es): Senior
Pre-Requisite(s): BL 4000(C) or BL 4001(C) or BL 4995(C)

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, Biological Sciences; May not be enrolled in one of the following Class(es): Senior
Pre-Requisite(s): BL 2020 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)
Seminesters Offered: Spring
Restrictions: Must be enrolled in one of the following Major(s): Clinical
Laboratory Science
Pre-Requisite(s): BL 4610

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)
Seminesters 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)
Seminesters 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)
Seminesters Offered: Fall
Restrictions: Must be enrolled in one of the following Major(s): Clinical
Laboratory Science, Biological Sciences; May not be enrolled in one of
the following Class(es): Freshman, Sophomore
Pre-Requisite(s): BL 2410 and BL 3640

BL 4650 - Immunohematology Techniques
Theory and practical applications. Emphasis will be placed on blood
antigens and antibodies, compatibility testing techniques, blood
typing and safety issues.
Credits: 1.0
Lec-Rec-Lab: (0-0-3)
Seminesters Offered: Fall
Restrictions: Must be enrolled in one of the following Major(s): Clinical
Laboratory Science, Biological Sciences; Must be enrolled in one of the
following Class(es): Junior, Senior
Pre-Requisite(s): BL 4720(C)

BL 4730 - 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)
Seminesters Offered: Spring

BL 4731 - 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)
Seminesters Offered: Spring
Restrictions: Must be enrolled in one of the following Major(s): Clinical
Laboratory Science
Pre-Requisite(s): BL 4630

BL 4820 - Biochemical Laboratory Techniques I
Laboratory techniques basic to biochemistry and molecular biology with
emphasis on protein isolation, characterization and kinetics.
Credits: 2.0
Lec-Rec-Lab: (0-1-3)
Seminesters Offered: Spring, Summer
Pre-Requisite(s): BL 4010(C) or CH 4710(C)

BL 4840 - Molecular Biology Techniques
Laboratory techniques in molecular biology, including methods of
recombinant DNA and techniques for identification, cloning, and
characterization of genes.
Credits: 3.0
Lec-Rec-Lab: (1-0-4)
Seminesters Offered: Fall, Summer
Restrictions: May not be enrolled in one of the following Class(es):
Freshman, Sophomore
Pre-Requisite(s): BL 2100(C) or BL 2200(C) or BL 4010(C) or BL 4020(C) or BL 4370(C)

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)
Seminesters 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 3230(C) and BL 4550(C) and BL 4640 and BL 4570 and BL 4730

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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): Biochem & Molec Biology-Bio Sc, Chemistry, Clinical Laboratory Science, Bioinformatics, Biological Sciences; May not be enrolled in one of the following Class(es): Freshman

Business

BUS 1100 - Introduction to Business
Introduction to planning, organizing, decision-making, leadership and control in a business. Business disciplines of accounting, finance, information systems, management, marketing, and operations are introduced, along with discussions of business ethics and social responsibility.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring, Summer

BUS 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 1160 or MA 1161

BUS 2200 - Business Law
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
Restrictions: May not be enrolled in one of the following Class(es): Freshman

BUS 2300 - 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 BUS 2100(C) or MA 2710(C) or MA 2720(C) or MA 3710(C) or MA 3720(C)

BUS 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

BUS 4900 - Research 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

BUS 4950 - Business Project
Students work individually or in a team on a project under the guidance of a faculty advisor. The student(s) 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; May not be enrolled in one of the following Class(es): Freshman, Sophomore

BUS 4990 - Special Topics in Business
Business topics of interest to students and faculty.
Credits: variable to 3.0; 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

BUS 4991 - Business Development I
Focuses on the development of a business plan including marketing plans, organization, distribution, and financial projections. Emphasis is on the senior design project or enterprise project assigned to the student.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): (BA 1100 or BUS 1100) and (BA 2110 or BUS 2300) and (BA 2300 or BA 2330 or ACC 2000) and (BA 2310 or BA 2340 or ACC 2100) and (BA 2500 or BUS 2200) and (BA 2700 or MGT 2000) and (BA 3200 or MIS 2000) and (BA 3400 or FIN 3000) and (BA 3610 or OSM 3000) and (BA 3700 or MGT 3000) and (BA 3800 or MKT 3000)

BUS 4992 - Business Development II
Completion and presentation of the business plan for the senior design project or enterprise project assigned to the student.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): BA 4991

Civil Engineering

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 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 3202 - Structural Analysis
Introduction to structural concepts and techniques for analyzing trusses, determinate and indeterminate beams, and frame structures. Apply concepts from statics and mechanics of materials to determine internal forces and deflections of structural members and systems, including loads and load paths.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring, Summer
Pre-Requisite(s): ENG 2120 or MEEM 2150

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CE 3331 - Professional Practice
Professional expectations of civil and environmental engineers demonstrated through readings, discussion, and writing. Topics include the consequences of engineering, design issues, legal aspects, ethical considerations, government requirements, management, leadership, and contract issues.
Credits: 2.0
Lec-Rec-Lab: (2-0-0)
Semesters Offered: Fall, Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore

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, Summer
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, Spring, Summer
Restrictions: May not be enrolled in one of the following Class(es): Freshman

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, Summer
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): (ENG 3200 or ENG 3507) and (MA 3710(C) or ENVE 3502(C) or CE 3710(C))

CE 3650 - Hydraulics and Hydrology
Course is intended for graduate students who need additional coursework in this subject matter. Topics covered include pipe flow, distribution networks, culverts, rivers and channels, hydrologic cycle, flooding, precipitation, infiltration, evaporation, and runoff. Same material as CE3620, but without the lab.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring
Restrictions: Permission of instructor required; Must be enrolled in one of the following Level(s): Graduate

CE 3710 - Uncertainty Analysis in Engineering
Introduction to probability, statistics, and uncertainty analysis with examples from civil engineering (e.g., models of vehicle arrivals, structural reliability, flood distributions). Topics include: discrete probability theory, probability distributions, parameter estimation, confidence intervals, hypothesis tests, linear regression, and model selection.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Pre-Requisite(s): MA 2160

CE 3730 - Systems Dynamics and Design
Introduces principles of systems engineering as applicable to studying the behavior of engineering systems such as transportation, utility service, construction, and project management systems. Students are introduced to Queueing Theory, Markov Chains, and System Dynamics.
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): (BUS 2100(C) or BA 2100 or MA 3710(C) or MA 2720(C) or CE 2710(C)) and (MA 1135 or MA 1160 or MA 1161)

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, Summer
Pre-Requisite(s): (GE 2000 or GE 2100) and (MEEM 2150 or ENG 2120) and (ENG 3200 or ENG 3507)

CE 4010 - Introduction to Consulting Engineering
Covers the role of consultants, organizational structure, accounting, getting work and dealing with clients, preparing proposals, presentations, estimating costs, project management, liability, and professional ethics.
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

CE 4020 - Computer Applications: Visualizing and Communicating Design Information
Problem-solving using industry standard software, such as Civil3D, is applied to civil and environmental engineering projects such as terrain modeling, earth work calculations, and pavement alignment. Concepts involving data management, data visualization, and risk analysis are introduced.
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): ENG 1003 and CE 3332 or CE 3401(C)

CE 4050 - Green Building Design
An overview of practice for designing and constructing sustainable building following Leadership in Energy and Environmental Design (LEED) guidelines. Intensive two week class will include hands on practice with LEED, energy modeling, and an exploration of sustainable construction.
Credits: 3.0
Lec-Rec-Lab: (2-0-2)
Semesters Offered: Summer
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore

CE 4101 - Bituminous Materials
Applications and properties of asphalt binder, aggregates for bituminous mixtures, and analysis and design of asphalt concrete mixtures. Includes asphalt cement production, rheology, chemistry, and grading, aggregate grading and blending, and mixture design and characterization. Also discusses asphalt mixture production, construction, and recycling.
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, Junior
Pre-Requisite(s): CE 3101
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 2201 or CE 3202

CE 4213 - Structural Concrete Design
Introduction to design of reinforced concrete structural components.
Analyze and design reinforced concrete beams, columns, and footings.
Understand material behavior, limit state criteria, and practical detailing
considerations. Application of the ACI 318 to cast-in-place and precast
systems.
Credits: 4.0
Lec-Rec-Lab: (0-3-2)
Semesters Offered: Spring
Pre-Requisite(s): CE 2201 or CE 3202

CE 4223 - Steel Design I
Behavior and design of structural steel members using both ASD and
LRDF approaches. Covers material behavior, external loads, and the
design of tension, compression, and flexural members (rolled, built-up,
and composite), and simple welded and bolted connections.
Credits: 4.0
Lec-Rec-Lab: (0-3-2)
Semesters Offered: Fall, Summer
Pre-Requisite(s): CE 2201 or CE 3202

CE 4233 - Structural Timber Design
Introduction to the use of wood as a structural engineering material.
Includes design of beams, columns, nailed and bolted connection, glulam
members, including tapered beams, tapered and curved beam, and
design of wood shear walls and diaphragms.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): CE 2201 or CE 3202

CE 4333 - Estimating and Planning of Construction Projects
Examination of the principles and techniques of estimating construction
costs leading to the development of an estimate and proposal
submission. The relationship between the contract specification,
drawings, and the estimate will be illustrated.
Credits: 3.0
Lec-Rec-Lab: (2-0-2)
Semesters Offered: Fall
Pre-Requisite(s): 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 4344 - Construction Scheduling
This course will introduce students to the basics of construction
scheduling. Topics covered will include: Fundamentals of different
scheduling methods such as Critical Path Method and linear scheduling.
Resource allocation in schedules, and Schedule monitoring and control
methods.
Credits: 3.0
Lec-Rec-Lab: (2-0-2)
Semesters Offered: Spring
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 4403 - Traffic Safety Engineering
Traffic crash reporting, crash information and record systems, driver
behavior, ROADSOFT, roadside design, road safety audits, intersection
safety analysis, and tort liability.
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): CE 3401 and CE 4402

CE 4404 - Railroad Engineering
Overview of basic elements and roles of rail transportation, history,
organizations and economics, safety, intercity and urban passenger rail,
freight operations, track-train dynamics, signals and communications,
motive power and equipment, track components, construction and
maintenance.
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): CE 3401 and CE 4402

CE 4405 - International Railroad Engineering
Overview of basic elements and roles of rail transportation, history,
organizations and economics, safety, intercity and passenger rail, freight
operations, track-train dynamics, signals and communications, motive
power and equipment, track components, construction and maintenance.
Incorporates technical field visits in the United States and Europe.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Summer
Restrictions: May not be enrolled in one of the following Class(es):
Freshman, Sophomore

CE 4406 - Airport Planning and Design
Introduction to the air transportation system, airport planning studies,
demand forecasting, aircraft characteristics, runway requirements, airport
layout and design. Also includes environmental impacts, airport capacity
and operations, terminal and ground access planning and analysis.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring

CE 4490 - Rail Transportation Seminar
Presentations and discussion of current literature and research related to
rail transportation.
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, Sophomore
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 4620 - River and Floodplain Hydraulics
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 4640 - Stormwater Management and Low Impact Development
Design techniques for stormwater collection, conveyance, infiltration, and detention storage systems are discussed, both traditional stormwater management systems and newer approaches based on the philosophy of low impact development (LID) that seek not to alter the natural ecology of a site.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Pre-Requisite(s): CE 3620

CE 4665 - Stream Restoration
Basic mechanics of the transport of sediments in natural systems, including tractive forces and geomorphic functions.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Pre-Requisite(s): CE 3620

CE 4750 - Risk Analysis and Management
Fundamentals methods in analyzing and mitigating risks involved in services that function at the interface of human, natural and engineered systems. Relevant systems include transportation, service, utility, emergency and hazard management, and project management.
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): OSM 3730 or CE 3730 or SSE 3730 or SSE 2300

CE 4760 - Optimization Methods in Design and Decision Making
Decision analysis and optimization techniques, including linear programming, nonlinear programming, and dynamic programming. Computer-based solutions of design problems in various engineering specialty areas are considered.
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): MA 2160 and (MA 2320 or MA 2321 or MA 2330)

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 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 4850 - Rock Engineering for Civil Engineers
This course focuses on the applied behavior of rock encountered primarily in civil engineering projects. Topics include rock classification, rock durability, rock mass strength classification, use of stereo nets, rock reinforcement, blasting, rock socket application and bearing capacity on rock.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2009-2010 academic year
Pre-Requisite(s): CE 3810

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 fulfill senior design requirements. Must be senior project ready as defined by major department.
Credits: 3.0
Lec-Rec-Lab: (0-2-3)
Semesters Offered: Fall, Summer
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, Summer
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 fulfill senior design requirements. Senior project ready as defined by major substitutes for prerequisites.
Credits: 3.0
Lec-Rec-Lab: (0-2-3)
Semesters Offered: Spring, Summer
Pre-Requisite(s): CE 4900

CE 4915 - International Engineering Field Experience
An engineering design project that incorporates an international experience. Must be taken in conjunction with CE4916 in order to fulfill senior design requirements. Must be senior project ready as defined by major department.
Credits: 3.0
Lec-Rec-Lab: (0-2-3)
Semesters Offered: Fall, Spring, Summer
Restrictions: Must be enrolled in one of the following Class(es): Senior
Pre-Requisite(s): ENG 3530
CE 4916 - International Senior Design Field Project
An engineering design project that incorporates an international experience. Must be taken in conjunction with CE4915 in order to fulfill senior design requirements. Senior project ready as defined by major substitutes for prerequisites.
Credits: 3.0
Lec-Rec-Lab: (0-2-3)
Semesters Offered: Fall, Spring, Summer
Restrictions: Must be enrolled in one of the following Class(es): Senior Pre-Requisite(s): CE 4915

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 4990 - Special Topics in Civil 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, Summer

Chemistry

CH 0100 - Chemistry Coaching
Scheduled weekly individual or study group session with an experienced chemistry coach to improve mastery of chemistry material, problem-solving skills, and awareness of expectations in first year chemistry.
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, Spring, Summer

CH 1112 - University Chemistry - Studio Laboratory I
Introduces experimental and theoretical chemical concepts from a hands-on, inquiry-based perspective. Emphasis is placed on experimental methods, reactions and stoichiometry, states of matter, thermochemistry, periodicity and bonding, solutions, and kinetics.
Credits: 5.0
Lec-Rec-Lab: (3-1-3)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Major(s): Biochem & Molec Biology-Chem, Pharmaceutical Chemistry, Chemistry, Cheminformatics
Pre-Requisite(s): MA 1031 or MA 1032

CH 1122 - University Chemistry - Studio Laboratory II
Introduces more complex experimental and theoretical concepts from a hands-on, inquiry-based perspective. Emphasis is on experimental methods, kinetics, equilibria, thermodynamics, electrochemistry, and special topics which may include chemical analysis, organic synthesis, computational methods, and biochemistry.
Credits: 5.0
Lec-Rec-Lab: (3-1-3)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Major(s): Biochem & Molec Biology-Chem, Pharmaceutical Chemistry, Chemistry, Cheminformatics
Pre-Requisite(s): CH 1112 or (CH 1150 and CH 1151)

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): Biochem & Molec Biology-Chem, Pharmaceutical Chemistry, Chemistry, Cheminformatics

CH 1150 - University Chemistry I
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 components.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring, Summer
Co-Requisite(s): CH 1150
Pre-Requisite(s): MA 1032(C) or MA 1160(C) or MA 1161(C) or MA 1135(C) or ACT Mathematics >= 19 or SAT Mathematics >= 500 or MTU Math Place. Test-Pre Calc >= 1 or MTU Math Place. Test-Calc Plus >= 1 or MTU Math Place. Test-Calculus >= 1

CH 1151 - University Chemistry Lab I
Laboratory to accompany CH1150.
Credits: 1.0
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Fall, Spring, Summer
Co-Requisite(s): CH 1151
Pre-Requisite(s): MA 1032(C) or MA 1160(C) or MA 1161(C) or MA 1135(C) or ACT Mathematics >= 19 or SAT Mathematics >= 500 or MTU Math Place. Test-Pre Calc >= 1 or MTU Math Place. Test-Calc Plus >= 1 or MTU Math Place. Test-Calculus >= 1

CH 1153 - University Chem Recitation I
Problem solving session to support University Chemistry I - CH1150.
Credits: 1.0
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Fall, Spring, Summer
Co-Requisite(s): CH 1150
Pre-Requisite(s): MA 1032(C) or MA 1160(C) or MA 1161(C) or MA 1135(C) or ACT Mathematics >= 19 or SAT Mathematics >= 500 or MTU Math Place. Test-Pre Calc >= 1 or MTU Math Place. Test-Calc Plus >= 1 or MTU Math Place. Test-Calculus >= 1

CH 1160 - University Chemistry II
A continuation of CH 1150. 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: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring, Summer
Co-Requisite(s): CH 1161
Pre-Requisite(s): CH 1112 or (CH 1150 and CH 1151)

CH 1161 - University Chemistry Laboratory II
Laboratory to accompany CH1160.
Credits: 1.0
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Fall, Spring, Summer
Co-Requisite(s): CH 1160
Pre-Requisite(s): CH 1112 or (CH 1150 and CH 1151)
CH 1163 - Problem Solving in University Chemistry II - CH1160
Problem solving session to support University Chemistry II - CH1160.
Credits: 1.0
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Fall, Spring, Summer
Co-Requirement(s): CH 1160
Pre-Requirement(s): CH 1150 and CH 1151

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-Requirement(s): CH 1122 or (CH 1160 and CH 1161)

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-Requirement(s): CH 1122 or (CH 1160 and CH 1161)

CH 2411 - Organic Chemistry Lab I
Laboratory to accompany CH2410.
Credits: 1.0
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Fall, Summer
Pre-Requirement(s): CH 2410(C) and CH 1122 or (CH 1160 and CH 1161)

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-Requirement(s): CH 2410

CH 2421 - Organic Chemistry Lab II
Laboratory to accompany CH2420.
Credits: 2.0
Lec-Rec-Lab: (0-0-4)
Semesters Offered: Spring, Summer
Pre-Requirement(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 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-Requirement(s): CH 1122 or CH 1170 or (CH 1160 and CH 1161) and
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 equilibria, 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, Summer
Pre-Requirement(s): CH 1122 or (CH 1160 and CH 1161) and MA 2160
and PH 2200(C)

CH 3511 - Physical Chemistry Lab I
Laboratory to supplement CH3510.
Credits: 2.0
Lec-Rec-Lab: (0-0-4)
Semesters Offered: Fall, Spring, Summer
Pre-Requirement(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-Requirement(s): CH 1122 or (CH 1160 and CH 1161) and MA 3160
and PH 2200(C)

CH 3521 - Physical Chemistry Lab II
Laboratory to supplement CH3520.
Credits: 2.0
Lec-Rec-Lab: (0-0-4)
Semesters Offered: Spring
Pre-Requirement(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-Requirement(s): (BL 1020 or BL 1040) and CH 1122 or (CH 1160 and
CH 1161) and MA 2160 and PH 2200

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
Pre-Requirement(s): CH 3540
CH 4110 - Pharmaceutical Chemistry: 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): BL 4010 or CH 4710

CH 4120 - Pharmaceutical Chemistry: 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 2420

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 - Bioanalytical Chemistry
An overview of modern analytical and instrumental techniques with emphasis on approaches relevant to measurements in biochemistry. Theory and methods of chromatographic separation methods, biomolecule quantification and electrophoretic characterization. Error analysis and statistical treatment of data also covered.
Credits: 5.0
Lec-Rec-Lab: (3-0-6)
Semesters Offered: Fall, Spring
Restrictions: May not be enrolled in one of the following Major(s): Cheminformatics, Chemistry; May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): CH 1122 or (CH 1160 and CH 1161) and CH 3510(C) and CH 3511(C)

CH 4230 - Solutions and pH
Laboratory-intensive course offered by arrangement. Students will learn proper solution preparation techniques. Acid-base equilibrium calculations will be introduced and buffer solutions prepared. Chemical safety will be integrated into all aspects of this course.
Credits: 1.0
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall
Restrictions: Permission of department required
Pre-Requisite(s): CH 1122 or (CH 1160 and CH 1161)

CH 4231 - Introduction to Spectroscopy
Laboratory-intensive course offered by arrangement. Students will learn how to recognize compounds suitable for spectoscopic analysis. Sample preparation, calibration methods, and chemical safety will be emphasized. An introduction to spectroscopic instrumention will also be given.
Credits: 1.0
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall
Restrictions: Permission of department required
Pre-Requisite(s): CH 1122 or (CH 1160 and CH 1161)

CH 4232 - Introduction to Gas Chromatography
Laboratory-intensive course offered by arrangement. Students will learn how to recognize compounds suitable for gas chromatographic analysis. Sample preparation and quantitative analysis will be emphasized. An introduction to GC instrumentation will also be given.
Credits: 1.0
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall
Restrictions: Permission of department required
Pre-Requisite(s): CH 1122 or (CH 1160 and CH 1161)

CH 4233 - Introduction to Liquid Chromatography
Laboratory-intensive course offered by arrangement. Students will learn how to recognize compounds suitable for liquid chromatographic analysis. Sample preparation and quantitative analysis will be emphasized. An introduction to LC instrumentation will also be given.
Credits: 1.0
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall
Restrictions: Permission of department required
Pre-Requisite(s): CH 1122 or (CH 1160 and CH 1161)

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
Descriptive chemistry of the main group elements with some emphasis on the structure and theory of bonding with transition metal complexes. Examines bonding, physical and chemical properties, structure, and reactions of the chemical elements and their compounds.
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 synthesis of molecules; measurement of chemical properties, structures, and phenomena; hands-on experience with modern instrumentation; computational data analysis (by means of single crystal X-ray Diffraction experiments).
Credits: 2.0
Lec-Rec-Lab: (0-0-4)
Semesters Offered: Fall
Pre-Requisite(s): CH 4310(C)

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CH 4320 - Inorganic Chemistry II
Continuation of CH4310. Descriptive chemistry of the transition group elements. Transition metal compounds; aspects of bonding, spectra, and reactivity; complexes of p-acceptor ligands; organometallic compounds and their role in catalysis; metals in biological systems; preparative, analytical, and instrumental techniques.
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-dimenional techniques, COSY, HETCOR, etc.), mass spectrometry, infrared spectrophotometry. Includes use of modern software, including NMR specractombelling, data handling and presentation, and spectral database packages.
Credits: 3.0
Lec-Rec-Lab: (2-0-2)
Semesters Offered: Spring
Pre-Requisite(s): CH 2420

CH 4439 - 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, Hammett 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 2430

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 or CH 3520(C) or ENVE 4501 or ENVE 4504

CH 4519 - Transport and Transformation of Organic Pollutants
Assessment of factors controlling environmental fate, distribution, and transformation of organic pollutants. Thermodynamics, equilibrium, and kinetic relationships are used to quantify organic pollutant, partitioning, and transformations in air, water, and sediments. Use of mass balance equations to quantify pollutant transport.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall - Offered alternate years beginning with the 2009-2010 academic year
Restrictions: Must be enrolled in one of the following Class(es): Senior
Pre-Requisite(s): ENVE 4501(C) or CH 3510

CH 4550 - 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: (2-0-3)
Semesters Offered: Fall - Offered alternate years beginning with the 2010-2011 academic year
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 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 1122 or (CH 1160 and CH 1161)

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 - Offered alternate years beginning with the 2008-2009 academic year
Pre-Requisite(s): CH 4610(C) or CM 4610(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, Summer
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: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): BL 4010 or CH 4710

CH 4721 - Research Methods in Biomolecular Chemistry
Lab course will emphasize the research process in biomolecular chemistry by actively involving students in question formulation, experimental design, data gathering, critical analysis, team work, and communication in an inquiry-based format. Students will employ methods used in modern biochemistry/molecular biology in a series of open-ended experiments that will lead to a student-developed original research project.
Credits: 3.0
Lec-Rec-Lab: (0-0-7)
Semesters Offered: Spring
Pre-Requisite(s): (CH 4710 and CH 4222) or CH 4212

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
Restrictions: Permission of department required

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 - Offered alternate years beginning with the 2013-2014 academic year
Pre-Requisite(s): CH 2420 and CH 2411 and CH 3020

CH 4910 - Chemistry Seminar
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)

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 instructor required

CH 4995 - Undergrad Research in Biochem
Undergraduate research experience in Biochemistry where students work on independent research projects under the direction of biochemistry faculty performing research in areas of biophysics, biochemistry, and molecular biology. Instructor permission required.
Credits: variable to 6.0; Repeatable to a Max of 12
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of instructor required

Chemical Engineering

CM 1000 - Introduction to Chemical Engineering
Introduces chemical engineering as a profession using the theme of industrial chemical production. Covered concepts include process flow diagrams, unit operations, green engineering, and career opportunities. Guest speakers from industry will provide their perspectives on working as a chemical engineer.
Credits: 1.0
Lec-Rec-Lab: (1-0-0)
Semesters Offered: Fall

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 1112 or (CH 1150 and CH 1151)

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 2110 and CM 2120

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 coefficients. 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
Restrictions: Must be enrolled in one of the following Major(s): Chemical Engineering
Pre-Requisite(s): CM 3110 and CM 2120 and (MA 3520 or MA 3521 or MA 3530 or MA 3560)

CM 3215 - Chemical Reaction Engineering
Studies 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, Senior
Pre-Requisite(s): UN 1015 or UN 2001

CM 3220 - Chemical Reaction Engineering
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: (2-2-0)
Semesters Offered: Fall, Spring
Restrictions: Must be enrolled in one of the following Major(s): Chemical Engineering
Pre-Requisite(s): CM 3110 and CM 2120 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 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: (2-2-0)
Semesters Offered: Spring
Pre-Requisite(s): (MA 3520 or MA 3521 or MA 3530 or MA 3560) and PH 2200 and CM 2110 and CM 2120

CM 3410 - Technical Communication for Chemical Engineering
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, Senior
Pre-Requisite(s): UN 1015 or UN 2001

CM 3450 - Computer-Aided Problem Solving in Chemical Engineering
The use of modern software packages in chemical engineering. Packages include spreadsheet, symbolic manipulator, chemical process calculator, statistical and modeling software. Course develops knowledge and skills in using computer tools that will complement chemical engineering courses and practice.
Credits: 3.0
Lec-Rec-Lab: (0-0-6)
Semesters Offered: Fall - Offered alternate years beginning with the 2008-2009 academic year
Pre-Requisite(s): CM 2110(C) and MA 2160

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 2110 and CM 3110 and CM 3230(C) and (MA 3520 or MA 3521 or MA 3530 or MA 3560) and CH 2410

CM 3820 - Sampling Statistics and Instrumentation
Solids sampling theory, practice, and instrumentation for process streams. Statistics/probability as they apply to representative samples from bulk lots. 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: (2-2-3)
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, Spring
Pre-Requisite(s): CH 1112 or (CH 1150 and CH 1151)

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; May not be enrolled in one of the following Level(s): Graduate
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
Restrictions: Must be enrolled in one of the following Major(s): Chemical Engineering
Pre-Requisite(s): CM 3120 and CM 3215 and CM 3230 and CM 3410(C) 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 quality assurance, the application of chemical 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
Restrictions: Must be enrolled in one of the following Major(s): Chemical Engineering
Pre-Requisite(s): CM 3215 and CM 3310 and 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 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: Fall, 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 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 1122 or (CH 1160 and CH 1161)

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

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 - Offered alternate years beginning with the 2007-2008 academic year
Pre-Requisite(s): CM 4610(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/Pyrro metallurgy
Extraction and refining of metals and industrial chemicals from natural and recycled materials. Includes solution-chemistry processes (hydrometallurgy) and thermochemical processes (pyrometallurgy).
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): CH 1122 or (CH 1160 and CH 1161)

CM 4770 - Analytical Microdevice Technologies
Course will provide background in micro/nano-scale technologies for biomedical diagnostic applications. Includes theoretical and experimental advances in chemical, mechanical, optical, and biological analysis. Reading of news and technical articles will develop skills/knowledge to envision microdevice applications for a semester-long project led by a graduate student team member.
Credits: 3.0
Lec-Rec-Lab: (1-1-2)
Semesters Offered: Fall - Offered alternate years beginning with the 2012-2013 academic year
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): PH 2200

CM 4780 - Biomanufacturing and Biosafety
This course will give students additional tools to perform as an engineer in a biomanufacturing facility. Focus is on mammalian cell culture derived products. Federal laws and compliance of biosafety in manufacturing facilities. Process design software will be introduced.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall - Offered alternate years beginning with the 2014-2015 academic year
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): BL 2100 or CH 4710 or CM 4710 or (CM 3110(C) and BL 1040)

CM 4855 - CM Process Analysis & Design 1
Capstone technical and economic evaluations of processes and unit operations. Application of cost estimation, energy efficiency, and economic evaluation techniques. Teams analyze an existing facility, identify improvement opportunities, demonstrate the economic consequences, and recommend a course of action.
Credits: 3.0
Lec-Rec-Lab: (2-0-3)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Major(s): Chemical Engineering
Pre-Requisite(s): CM 3120 and CM 3230 and CM 3410(C) and CM 3510 and CH 2410

CM 4860 - CM Process Analysis & Design 2
Process and project design principles applied to realistic problems, including project evaluation and management. Problems include safety, environmental, and operability constraints. Emphasizes the profit motive in industry and the role of the chemical engineer.
Credits: 2.0
Lec-Rec-Lab: (2-0-0)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Major(s): Chemical Engineering
Pre-Requisite(s): CM 4855

CM 4861 - CM Design Laboratory 2
Individual/team projects to optimize designs for new ventures with realistic constraints. Requires process synthesis, market research, economic evaluation, and risk analysis techniques. Develops skills in problem solving, critical thinking, and communication. May include the AIChE National Student Design problem.
Credits: 1.0
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Major(s): Chemical Engineering
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: variable to 3.0
Semesters Offered: Fall
Restrictions: Permission of department required; May not be enrolled in one of the following Class(es): Chemical Engineering

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: (0-3-0)
Semesters Offered: Spring
Restrictions: Permission of department required; May not be enrolled in one of the following Class(es): Chemical Engineering

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 1000 - Introduction to Construction Management
Introduction to the construction management profession, and current issues and trends in residential and commercial construction industries. Focuses on how the construction industry works, along with enhancing verbal, CAD, and print reading skills.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Class(es): Chemical Engineering

CMG 1140 - Basic Construction Materials
Covers properties and behavior of basic construction materials, including wood, metals, aggregates, asphalt, concrete, and composites. Laboratory exercises include field testing techniques, materials standards, report writing, and presentation of data.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Spring

CMG 2110 - Building Utility Systems
Overview of the mechanical, electrical, and plumbing components of building systems. HVAC systems and controls, water supply and drainage, electrical power distribution and lighting, fire detection, alarm, and communications. Includes construction drawing interpretation and design projects.
Credits: 4.0
Lec-Rec-Lab: (0-4-0)
Semesters Offered: Fall
Pre-Requisite(s): PH 1240(C)

Graduate Course Descriptions
CMG 2120 - Statics and Strengths of Materials for Construction
Composition and resolution of forces and force systems, principles of equilibrium applied to various bodies, simple structures, friction, centroids, and moments of inertia. Mechanical behavior of materials, including calculation of stresses, strains, and deformations due to axial, torsional, and flexural loading.
Credits: 4.0
Lec-Rec-Lab: (0-3-2)
Semesters Offered: Spring
Pre-Requisite(s): PH 1110 or PH 1140

CMG 2140 - Building Materials & Methods
Materials, structural systems, building codes, and management procedures appropriate for residential and commercial construction. Includes construction drawing interpretation and graphic design project.
Credits: 4.0
Lec-Rec-Lab: (0-3-2)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): CMG 1000 and CMG 1140

CMG 2285 - 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: Spring
Restrictions: Must be enrolled in one of the following Class(es): Sophomore, Junior, Senior
Pre-Requisite(s): CMG 1000 and CMG 1140

CMG 3200 - Site Planning and Development
An examination of land development issues including: site analysis, environmental concerns, contouring, earthwork and grading, soils, route alignments, storm water management, sewer systems, zoning, and land planning. Incorporates CAD applications in the lab.
Credits: 4.0
Lec-Rec-Lab: (0-3-2)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): SU 2000

CMG 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: Fall
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): CMG 2120 or ENG 2120 or MET 2120

CMG 3265 - Construction Cost Estimating
Advanced study of construction cost estimating topics. Includes conceptual estimating, unit price development, subcontract work, budgets, negotiated contracts, and related items. Extensive use of spreadsheets and estimating.
Credits: 4.0
Lec-Rec-Lab: (0-3-2)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): CMG 2265

CMG 4000 - Design-Build Project Delivery
Professional practice, financial, legal, and ethical considerations in construction management are illustrated and discussed in the context of the design-build delivery system.
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): CMG 3200(C)

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: On Demand
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): CMG 3265 and EC 3400

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: Spring
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): CMG 3265

CMG 4200 - Construction Contracts
Legal aspects of construction to include 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): Junior, Senior
Pre-Requisite(s): BA 2500 or BUS 2200

CMG 4210 - Construction Project Management
Provides students with an understanding of the principles required to deliver a construction project on time, within budget, and with acceptable quality. Topics include construction law, contracts, delivery systems, job site layout and control, submittals, record keeping, subcontracting and purchasing, quality management, change orders, claims, and dispute resolution.
Credits: 4.0
Lec-Rec-Lab: (0-3-2)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): CMG 4200

CMG 4300 - Construction Finance and Accounting
Focuses on the principles of accounting and financial management needed to make construction projects and companies financially successful. Includes profitability, projecting costs, cash flow and cash requirements, and equipment costs.
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): (BA 2300 or ACC 2000) and EC 3400
CMG 4400 - Construction Safety Management
Provides an awareness and understanding of workplace safety practices. Emphasis on the construction industry, including the OSHA construction regulations.
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 4800 - Sustainable Construction
An introduction to the philosophy and practice of sustainable building construction with emphasis on underlying socio-environmental philosophies, sustainable directed building technologies and materials, and case studies of contemporary green buildings to culminate in a simple sustainable design project.
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

CMG 4900 - Construction Project Simulation
Capstone course. Integrates all aspects of the construction management process. Students will explore the responsibilities of the construction manager and consider project management issues through semester-long simulated construction projects (commercial and design-build). Includes oral and written report components.
Credits: 4.0
Lec-Rec-Lab: (0-3-2)
Semesters Offered: 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
Pre-Requisite(s): CMG 3200 and CMG 3250 and CMG 4120(C) and CMG 4210 and HU 3120

CMG 4996 - Special Topics in Construction Management
Selected additional topics of interest in Construction Management based on student and faculty demand and interest. May be a tutorial, seminar, workshop, project, or class study.
Credits: variable to 3.0; Repeatable to a Max of 6
Semesters Offered: On Demand
Restrictions: Permission of instructor required; Must be enrolled in one of the following Major(s): Construction Management; Must be enrolled in one of the following Class(es): Senior

CMG 4997 - Independent Study in Construction Management
Independent study of an approved topic under the guidance of a Construction Management faculty member. May be either an academic, design or research problem/project.
Credits: variable to 3.0; Repeatable to a Max of 6
Semesters Offered: On Demand
Restrictions: Permission of instructor required; Must be enrolled in one of the following Major(s): Construction Management; Must be enrolled in one of the following Class(es): Senior

CMG 4998 - Undergraduate Research in Construction Management
An undergraduate research experience in Construction Management. Under the guidance of a Construction Management faculty member, students work on a selected/approved research problem or work directly with faculty on active research projects/grants. May require more than one semester to complete.
Credits: variable to 6.0; Repeatable to a Max of 6
Semesters Offered: On Demand
Restrictions: Permission of instructor required; Must be enrolled in one of the following Major(s): Construction Management; Must be enrolled in one of the following Class(es): Senior

CMG 4999 - Professional Practice Seminar
Expand student knowledge on topics relevant to the construction profession through participation in NAHB and other applicable venues.
Credits: 1.0; Repeatable to a Max of 6
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring
Restrictions: Must be enrolled in one of the following Class(es): Sophomore, Junior, Senior

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): Software Engineering, Computer Science, Computer Systems Science, Computer Engineering, Electrical Engineering; Must be enrolled in one of the following Class(es): Freshman

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 1111 - Introduction to Programming in C/C++
Introductory course in C/C++ programming. Topics include top-down analysis of problems, structured programming, control structures, functions, arrays, pointers, and file I/O. Basic concepts of object-oriented programming (classes, objects, function overloading) will also be introduced.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Major(s): Industrial Technology, Computer Network & System Admn; Must be enrolled in one of the following Class(es): Freshman, Sophomore

CS 1121 - Introduction to Programming 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 1031(C) or MA 1032(C)

CS 1122 - Introduction to Programming II
Continuation of CS 1121. Topics include data abstraction, class hierarchies and polymorphism, list, stack, queue and tree data structures, complexity-based algorithm and data structure choices, and recursion. Homework programming assignments are given.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring, Summer
Pre-Requisite(s): CS 1121
CS 1131 - Accelerated Introduction to Programming
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: 5.0
Lec-Rec-Lab: (0-4-2)
Semesters Offered: Fall
Restrictions: Permission of department required
Pre-Requisite(s): MA 1031 or MA 1032

CS 1141 - C for Java Programmers
Programming in C for students with prior experience in Java. Topics include program structure, the preprocessor, arrays, structures, pointers, input/output, dynamic memory management, and linked data structures.
Credits: 2.0
Lec-Rec-Lab: (0-2-0)
Semesters Offered: Fall, Spring, Summer
Pre-Requisite(s): CS 1122 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 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, Summer
Pre-Requisite(s): (CS 1122 or CS 1131) and (MA 1135 or MA 1160 or MA 1161)

CS 2321 - Data Structures
Presents fundamental concepts in data structures. Topics include abstract data types (priority queues, dictionaries and graphs) and their implementations, algorithm analysis, sorting, text processing, and object oriented design. A significant programming project is assigned.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring, Summer
Pre-Requisite(s): CS 1122 or CS 1131

CS 3000 - Ethical and Social Aspects of Computing
An examination of social and ethical issues associated with computing. Topics include: ethical theories and decision making, intellectual property, freedom of expression, privacy, security, and professional responsibility.
Credits: 2.0
Lec-Rec-Lab: (0-2-0)
Semesters Offered: Fall, Spring
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): CS 3141

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 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 properties (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 1141 and CS 2321 and CS 3421 and CS 3311

CS 4130 - Compiler Design and Optimization
Design, theory, and implementation of programming language translators. Topics include: intermediate representations, advanced code generation, control and data-flow analysis, advanced compiler optimization, dynamic compilation, global register allocation and instruction scheduling. A major project is required.
Credits: 4.0
Lec-Rec-Lab: (0-3-3)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Level(s): Graduate
Pre-Requisite(s): CS 4121

CS 4231 - 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
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): CS 2311 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 3331 and CS 3421 and CS 4321

CS 4411 - Operating Systems
Principles of the design and implementation of operating systems. Topics include: process management, process scheduling, memory management, I/O, file systems. Includes a significant implementation component.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): CS 3331 and CS 3421

CS 4421 - Database Systems
Topics include goals of database management; data definition; data models; 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
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): CS 2321

CS 4431 - Computer Architecture
Advanced course in architecture of high-performance computer systems. Topics include instruction-set design, simulation of processor architectures, multiple functional units, pipelining, dynamically scheduled pipelines, speculative execution, multi-core and multi-processor systems, advanced I/O subsystems and analytic models of architectural features of processors.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring
Pre-Requisite(s): CS 3421

CS 4441 - 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, and network performance analysis.
Credits: 4.0
Lec-Rec-Lab: (0-3-3)
Semesters Offered: Spring
Pre-Requisite(s): CS 3451 and CS 4461(C)

CS 4451 - Computer Networks
Computer network architectures and protocols; design and implementation of datalink, network, and transport layer functions. Introduction to the Internet protocol suite (TCP, UDP, IP), domain name service and protocols, file sharing protocols, wireless networks, and network security.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): CS 3411

CS 4471 - Computer Security
Development and administration of secure software systems. Topics include principles of software development, practical cryptography, program security, operating system security, database security, administration, legal and ethical issues.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): CS 3411 or CS 4411

CS 4496 - GPU and Multicore Programming
Introduction to Graphics Processing Units (GPU) and multi-core systems, their architectural features and programming models, stream programming and compute unified driver architecture (CUDA), caching architectures, linear and non-linear programming, scientific computing on GPUs, sorting and search, stream mining, cryptography, and fixed and floating point operations.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Level(s): Graduate
Pre-Requisite(s): CS 3411 and CS 3421
CS 4611 - Computer Graphics
Introduction to interactive computer graphics. Topics include 3D viewing, 3D transformation, interactive techniques, animation, modeling, lighting, texturing, vertex programs, fragment programs, and graphics algorithms. Requires substantial programming homework.
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): CS 1141 and CS 2321 and MA 2330

CS 4710 - Model-Driven Software Development
Focuses on the use of formal models throughout the software development life cycle. Topics include formal specification of requirements, behavioral modeling, automated analysis, architectural styles and design specification.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Pre-Requisite(s): CS 3111 and CS 3141(C)

CS 4711 - Software Processes and Management
Focuses on the software development process and related management issues. Topics include software process models, the Capability Maturity Model, process tools, use of standards, software maintenance, configuration management, project planning and tracking, team management, and measurement and estimation.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Pre-Requisite(s): CS 3141

CS 4712 - Software Quality Assurance
Covers the notion of software quality and how to ensure quality through the software process. Topics include requirements elicitation, analysis and documentation; usability and accessibility; testing; and quality assurance management.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
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 4751 - Artificial Intelligence
Covers the notion of software quality assurance. Includes requirements elicitation, analysis and documentation; usability and accessibility; testing; and quality assurance management.
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): CS 2321 and CS 3111

CS 4792 - Senior Software Engineering Project II
A continuation of the capstone project experience, intended for Software Engineering majors.
Credits: 3.0
Lec-Rec-Lab: (0-1-4)
Semesters Offered: Fall, Spring
Restrictions: Permission of instructor required
Pre-Requisite(s): CS 4791

CS 4811 - Artificial Intelligence
Fundamental ideas and techniques that are used in the construction of problem solvers that use Artificial Intelligence technology. Topics include knowledge representation and reasoning, problem solving, heuristics, search heuristics, inference mechanisms, and machine learning.
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): CS 2321 and CS 3111

CS 4821 - Data Mining
Data mining focuses on extracting knowledge from large data sources. The course covers data mining concepts, methodology (measurement, evaluation, visualization, etc.), algorithms (classification/regression, clustering, association rules, etc.), and applications (web mining, recommender systems, bioinformatics, etc.).
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Restrictions: Permission of instructor required
Pre-Requisite(s): (MIS 3100 or CS 4421) and (MA 2330 or MA 2320 or MA 2321) and (MA 2710 or MA 2720 or MA 3710) and MA 3740

Economics
EC 2001 - 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
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): MA 1020 or MA 1031 or MA 1032 or MA 1135(C) or MA 1160(C) or MA 1161(C)

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
Pre-Requisite(s): EC 2001 and (MA 1135 or MA 1160 or MA 1161)

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
Pre-Requisite(s): EC 2001 and (MA 1135 or MA 1160 or MA 1161)
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 2001

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: Fall, Spring, Summer
Pre-Requisite(s): EC 2001

EC 3400 - Economic Decision Analysis
Studies economic decision-making for actions occurring over time. Covers decision tools for comparing alternatives, public project evaluation, risk and uncertainty, mutually exclusive decisions, multiple objective decisions, interest rate calculations, cash flow analysis, depreciation and taxes, cost of capital, capital budgeting.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring, Summer
Restrictions: May not be enrolled in one of the following Major(s): Finance, Operations and Systems Mgmnt, Management Information Systems, Marketing, Accounting, Management; May not be enrolled in one of the following Class(es): Freshman, Sophomore

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 4050 - 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
Restrictions: May not be enrolled in one of the following Class(es): Freshman

EC 4100 - Mathematical Economics
Application of the principal mathematical techniques used in economic theory and modeling. Topics include optimization, marginal analysis, comparative statics, and other applications.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Pre-Requisite(s): EC 3002 and EC 3003 and (MA 1160 or MA 1161 or MA 1135)

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 2001 or EC 3002 or EC 3003) and (BA 2100 or BUS 2100 or MA 2710 or MA 2720 or MA 3710) and (MA 1135 or MA 1160 or MA 1161)

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: Fall, Spring
Pre-Requisite(s): EC 3003 or BA 3400 or FIN 3000

EC 4500 - 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: Fall
Pre-Requisite(s): EC 2001

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 2001

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 - Offered alternate years beginning with the 2009-2010 academic year
Pre-Requisite(s): EC 2001

EC 4640 - Natural Resource Economics
Studies the economics of nonrenewable resources (energy and minerals) and renewable resources (water, fisheries, forests and species). Discusses the economics of land use change, macroeconomic topics such as economic growth, sustainability and green accounting.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Pre-Requisite(s): EC 2001 or EC 3002 or FW 4080

EC 4650 - Environmental Economics
Considers the efficient and equitable use of environmental resources, including air, water, land, wilderness and parks, wildlife and other ecological systems. Measures the benefits and costs of decreasing pollution, cleaner environment, and protecting scarce ecological resources. Addresses market failures and the economic valuation of environmental amenities.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Pre-Requisite(s): EC 2001 or EC 3002

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**EC 4710 - 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
**Rec-Lec-Lab:** (3-0-0)
**Semesters Offered:** On Demand
**Pre-Requisite(s):** EC 2001 and (BA 2100 or MA 2710 or MA 2720 or MA 3710)

**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 2001

**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 2001

**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
**Rec-Lec-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
**Rec-Lec-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.

**Credits:** 2.0
**Rec-Lec-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
**Rec-Lec-Lab:** (3-0-0)
**Semesters Offered:** Fall, Spring, Summer
**Restrictions:** May not be enrolled in one of the following Class(es): Freshman, Sophomore

**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
**Rec-Lec-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
**Co-Requisite(s):** ED 3110, ED 3410

**ED 3410 - Clinical Experience**
Observation, tutoring and classroom teaching in an area school classroom. This course is one component of the Teacher Education Early Block. Requires admission to the Teacher Education program.

**Credits:** 1.0
**Rec-Lec-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
**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
**Rec-Lec-Lab:** (0-0-2)
**Semesters Offered:** Fall, Spring, Summer

**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
**Rec-Lec-Lab:** (0-0-1)
**Semesters Offered:** Fall, Spring, Summer

**ED 4020 - Methods of Teaching Social Studies**
Application of learning and instructional theories and practice to 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
**Rec-Lec-Lab:** (0-2-0)
**Semesters Offered:** Spring
**Restrictions:** Permission of department required
**Pre-Requisite(s):** ED 4700(C)

**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
**Rec-Lec-Lab:** (0-3-3)
**Semesters Offered:** Fall
**Restrictions:** Permission of department required
**Pre-Requisite(s):** ED 4700(C)
ED 4150 - Literacy in the Content Areas
An introduction to the best ways to use language for deepening comprehension and understanding of all the content areas. Includes inquiries into how cultural and learning differences relate to comprehension. A minimum of 28 tutoring hours in a local school is required.
Credits: 4.0
Lec-Rec-Lab: (0-3-1)
Semesters Offered: Fall, Spring
Pre-Requisite(s): ED 3110 and ED 3210 and ED 3410

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

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: (0-2-2)
Semesters Offered: Fall, Spring
Restrictions: Permission of instructor required

ED 4720 - Methods of Teaching Science
Application of learning and instructional theories to the teaching of science.
Credits: 2.0
Lec-Rec-Lab: (1-0-2)
Semesters Offered: Fall, Spring
Restrictions: Permission of department required; May not be enrolled in one of the following Class(es): Freshman, Sophomore
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

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 (ED 4720 or HU 4140 or SS 4020(C) or MA 4905)

Electrical & Computer Engng

EE 1110 - Essential Mathematics for Electrical Engineering
Review of basic trigonometry, sinusoidal signals, amplitude, frequency and phase, addition of sinusoids. Complex numbers and complex arithmetic. Real exponential functions, complex exponentials, Euler's relations, decaying sinusoids and complex exponential functions. Differentiation and integration of sinusoids and exponentials.
Credits: 1.0; Graded Pass/Fail Only
Lec-Rec-Lab: (1-0-0)
Semesters Offered: Fall, Spring, Summer
Restrictions: Must be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): MA 1160 or MA 1161

EE 2111 - Electric Circuits I
This course will cover basic electrical concepts, resistive circuits, nodal and loop analysis techniques, superposition, Thevenin and Norton equivalents, maximum power transfer, capacitance and inductance, AC steady-state analysis, steady-state power analysis.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring, Summer
Pre-Requisite(s): EE 1110 and MA 2160

EE 2112 - Electric Circuits II and Lab
This course will cover operational amplifiers, first and second order transient circuits, magnetically coupled networks, polyphase circuits, variable frequency network performance, the Laplace transform, application of the Laplace transform to circuit analysis, Fourier analysis techniques, two port networks.
Credits: 4.0
Lec-Rec-Lab: (3-0-2)
Semesters Offered: Fall, Spring, Summer
Pre-Requisite(s): EE 2111 and (MA 3520 or MA 3521 or MA 3530 or MA 3560)

EE 2174 - Digital Logic and Lab
Introduces analysis, design, and application of digital logic. Includes Boolean algebra, binary numbers, logic gates, combinational and sequential logic, storage elements and hardware-description-language based synthesis.
Credits: 4.0
Lec-Rec-Lab: (3-0-2)
Semesters Offered: Fall, Spring
Pre-Requisite(s): EET 2241(C) or EE 2241(C) or CS 1121(C) or CS 1131(C)
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Prerequisites</th>
<th>Credits</th>
<th>Semesters Offered</th>
<th>Restrictions</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>EE 2241</td>
<td>C++ and Matlab Programming</td>
<td>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.</td>
<td>3.0</td>
<td>Fall, Spring, Summer</td>
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<td>Focuses on the basics capabilities of MATLAB and its programming environment.</td>
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<tr>
<td>EE 2304</td>
<td>Logic and Signals Lab</td>
<td></td>
<td>1.0</td>
<td>Fall, Spring, Summer</td>
<td></td>
<td>Experimental solution of engineering problems. Includes design, simulation, and evaluation; advanced measurement techniques in digital and signal processing systems.</td>
</tr>
<tr>
<td>EE 3010</td>
<td>Circuits and Instrumentation</td>
<td>Designed for nonmajors. Covers the principles of electrical and electronic measurements, including dc, ac, semiconductor devices, amplifiers, and filtering.</td>
<td>3.0</td>
<td>Fall, Spring, Summer</td>
<td></td>
<td>Introduction to circuits and instrumentation. Includes operational amplifiers, bipolar junction transistors, diodes, and MOSFETs.</td>
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<tr>
<td>EE 3120</td>
<td>Electric Energy Systems</td>
<td>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.</td>
<td>3.0</td>
<td>Fall, Spring, Summer</td>
<td></td>
<td>Covers the fundamentals of electronic devices and circuits: operational amplifiers, bipolar junction transistors, diodes, and MOSFETs.</td>
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<tr>
<td>EE 3140</td>
<td>Electromagnetics</td>
<td>Covers basic principles of engineering electromagnetics with an emphasis on Maxwell's equations.</td>
<td>3.0</td>
<td>Fall, Spring</td>
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<tr>
<td>EE 3160</td>
<td>Linear Systems and Control</td>
<td>Introduces the mathematical analysis of signals, systems, and control. Topics include differential equations, Fourier transforms, Laplace transforms, frequency response, Bode plots, state models, and an introduction to control systems.</td>
<td>3.0</td>
<td>Fall, Spring, Summer</td>
<td></td>
<td>Introduces the concepts of control systems. Describes basic characteristics of control systems, then goes into significant detail in the applications of a specific control system. Topics include C and assembly language programming, instruction set interface, ASICs, and polled, interrupt, and DMA input/output.</td>
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<tr>
<td>EE 3171</td>
<td>Microcontroller Applications</td>
<td>Introduces the concepts of microcontroller-based systems. Describes basic characteristics of microcontrollers, then goes into significant detail in the applications of a specific microcontroller. Topics include C and assembly language programming, instruction set interface, ASICs, and polled, interrupt, and DMA input/output.</td>
<td>4.0</td>
<td>Fall, Spring, Summer</td>
<td></td>
<td>Introduces the concepts of microcontroller-based systems. Describes basic characteristics of microcontrollers, then goes into significant detail in the applications of a specific microcontroller. Topics include C and assembly language programming, instruction set interface, ASICs, and polled, interrupt, and DMA input/output.</td>
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<tr>
<td>EE 3173</td>
<td>Hardware/Software System Integration</td>
<td>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 &quot;C&quot;, system integration and testing. Also covers the use of FPGAs and HDL design tools.</td>
<td>3.0</td>
<td>Fall, Spring, Summer</td>
<td></td>
<td>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 &quot;C&quot;, system integration and testing. Also covers the use of FPGAs and HDL design tools.</td>
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<tr>
<td>EE 3190</td>
<td>Optical Sensing and Imaging</td>
<td>Optical sensing techniques, including imaging and non-imaging systems.</td>
<td>3.0</td>
<td>Fall, Spring</td>
<td></td>
<td>Optical sensing techniques, including imaging and non-imaging systems.</td>
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EE 3261 - 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.); analog and digital simulation; and experiments with physical systems.
Credits: 3.0
Lec-Rec-Lab: (2-0-2)
Semesters Offered: Fall, Spring
Pre-Requisite(s): EE 3160

EE 3291 - Photonic Material and 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): Physics, Applied Physics, Electrical Engineering, Metallurgical & Materials Engr; Must be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): EE 3090 or EE 3140 or PH 2400

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 3901 - Design Fundamentals
The design process; includes team design activities and studies project management, ethics, and professionalism.
Credits: 2.0
Lec-Rec-Lab: (2-0-0)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Class(es): Junior, Sophomore
Pre-Requisite(s): EE 3131(C) and (UN 1015 or UN 2001)

EE 4000 - Undergraduate Research
An undergraduate research experience during the senior year in electrical or computer engineering. Students work on an active research project/grant with a faculty member. A report will be published in the department and archived.
Credits: variable to 4.0; Repeatable to a Max of 6
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of instructor required; Must be enrolled in one of the following Class(es): Junior, Senior

EE 4173 - Computer Systems: Architecture and Performance
Covers the principles and practices of modern computer architecture. Emphasizes quantitative performance evaluation of: memory hierarchies, from cache through virtual memory; pipelined processors with advanced hazard management; and combined processor/memory systems. Introduces RAID, superscalars, parallel processing, cache coherence, performance simulation software.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring
Restrictions: Must be enrolled in one of the following Major(s): Computer Engineering
Pre-Requisite(s): CS 3421 and EE 3173

EE 4219 - Introduction to Electric Machinery and Drives
Provides a thorough understanding of how electric machines can be used to drive loads with control of speed, torque, and position. Topics include basic electro-mechanics, rotating machinery, dc machines, ac machines, power electronics and load modeling. Applications include industrial systems, hybrid/electric vehicles and electric power systems.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Pre-Requisite(s): EE 2110 or EE 3010

EE 4220 - Introduction to Electric Machinery and Drives Laboratory
Provides a hands on understanding of how electric machines can be used to drive loads with control of speed, torque, and position. Topics include basic electro-mechanics, rotating machine, dc machines, ac machines, power electronics, and load modeling.
Credits: 1.0
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Spring
Pre-Requisite(s): EE 4219(C)

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: (3-0-0)
Semesters Offered: Fall and (EE 2112 or EE 2110)

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: (3-0-0)
Semesters Offered: Spring
Pre-Requisite(s): EE 4221

EE 4226 - Power Engineering Laboratory
A laboratory based course highlighting single phase and three phase power concepts, including: power factor, single and three phase transformer configurations, non-ideal transformers, synchronous machines, renewable energy, power flow and fault simulations, relay settings and relay testing and calibration.
Credits: 1.0
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Spring, Summer
Restrictions: Permission of instructor required
Pre-Requisite(s): EE 4221 and EE 4222(C)

EE 4227 - Power Electronics
Fundamentals of circuits for electrical energy processing. Covers switching converter principles for dc-dc, ac-dc, and dc-ac power conversion. Other topics include harmonics, pulse-width modulation, feedback control, magnetic components and power semiconductors.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Pre-Requisite(s): EE 3120 and (EE 3130(C) or EE 3131)

EE 4228 - Power Electronics Lab
Fundamentals of design, construction and control of circuits for electrical energy processing. Covers switching converter principles for dc-dc, ac-dc, and dc-ac power conversion. Other topics include harmonics, pulse-width modulation, feedback control, magnetic components and power semiconductors.
Credits: 1.0
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Fall
Pre-Requisite(s): EE 4227(C)
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: (3-0-0)

Semesters Offered: Fall

Pre-Requisite(s): EE 3090 or EE 3140 and EE 3160

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, and wave-shaping circuits.

Credits: 3.0

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

Semesters Offered: Spring

EE 4236 - Optical Communications
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: (3-0-2)

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, Junior

EE 3291 - 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 4235 - Digital Signal Processing and its 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: (3-0-2)

Semesters Offered: Fall

Pre-Requisite(s): EE 3160

EE 4236 - 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 3090 or EE 3140 and EE 3160

EE 4271 - VLSI Design
Design of VLSI circuits using CAD tools. Analysis of physical factors affecting performance.

Credits: 4.0

Lec-Rec-Lab: (3-0-2)

Semesters Offered: Fall, Summer

Pre-Requisite(s): EE 3261

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: (3-0-0)

Semesters Offered: Fall

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

Pre-Requisite(s): MA 3710 or MA 3720 or EE 3180

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

Credits: 3.0

Lec-Rec-Lab: (3-0-2)

Semesters Offered: Spring

Restrictions: Must be enrolled in one of the following Major(s): Electrical Engineering

Pre-Requisite(s): EE 3291

EE 4295 - Introduction to Propulsion Systems for Hybrid Electric Vehicles
Hybrid electric drive vehicle analysis will be developed and applied to examine the operation, integration, and design of powertrain components. Model based simulation and design is applied to determine vehicle performance measures in comparison to vehicle technical specifications. Power flows, losses, energy usage, and drive quality are examined over drive-cycles via application of these tools.

Credits: 3.0

Lec-Rec-Lab: (3-0-2)

Semesters Offered: Fall, Summer

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

Pre-Requisite(s): (MEEM 2200 or ENG 3200) and (MEEM 4700 or EE 3261)

EE 4296 - Introduction to Propulsion Systems for Hybrid Electric Vehicle Laboratory
Hybrid electric drive vehicles and their powertrain components will be examined from the aspects of safety, testing and analysis, energy conversion, losses, and energy storage, and vehicle technical specifications and vehicle development process. The lab will culminate with vehicle testing to perform power flow and energy analysis during a drive-cycle.

Credits: 2.0

Lec-Rec-Lab: (0-1-2)

Semesters Offered: Fall

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

Pre-Requisite(s): MEEM 4295(C) or EE 4295(C)

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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 from a quantum mechanical perspective.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Pre-Requisite(s): EE 3140

EE 4445 - Software/Hardware Design of Multimedia Systems
A comprehensive overview of the design and implementation of the hardware and software of a platform for multimedia applications. Topics include system level design methodology, single-instruction-multiple data processor (SIMD), virtual platform implementation, development of an SIMD parallel compiler, and real-time operating systems. (RTOS).
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Level(s): Graduate
Pre-Requisite(s): CS 3411 and EE 4173

EE 4723 - Computer and Network Security
Learn fundamental of cryptography and its application to network security. Understand network security threats, security services, and countermeasures. Acquire background knowledge on well known network security protocols. Address open research issues in network security.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Pre-Requisite(s): EE 4272

EE 4732 - Real-Time System Design
Introduces the fundamentals of Real-Time system design from practicing engineer's point of view. Focus will be on hardware, operating system, and software issues with topics derived from scheduling theory, algorithms, computer architecture and organization, hardware design, and operating systems.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Pre-Requisite(s): EE 3173 or EE 4431 or CS 4431 or EE 4173

EE 4735 - Embedded Systems Engineering
Covers the use of low-power microcontrollers in embedded sensing and control systems. Topics include: hardware- dependent C programming, commercial I/O devices, configuring I/O ports to interface with analog and digital sensors, actuators, transmitters, receivers, mobile robots, and wireless sensor nets.
Credits: 3.0
Lec-Rec-Lab: (2-0-2)
Semesters Offered: Spring
Pre-Requisite(s): (CS 1141 or EE 2241) and (EE 3170 or EE 3171 or EE 3173)

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 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: (1-0-3)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior
Pre-Requisite(s): EE 3131 or (EE 3130 and EE 3305) and (EE 3901 or EE 4900) and (EE 3170(C) or EE 3171(C) or EE 3173(C))

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: 2.0
Lec-Rec-Lab: (0-1-3)
Semesters Offered: Spring - Offered alternate years beginning with the 2013-2014 academic year
Pre-Requisite(s): EE 4901

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EET 2010 - Computational and Statistical Applications
Solve complex computational problems by using appropriate software (Mathcad or MATLAB) to generate solutions. Includes time series and frequency analysis (Fourier, Laplace, Z transforms), statistical analysis of experimental data, and topics such as experimental design, factor analysis, and quality control.
Credits: 3.0
Lec-Rec-Lab: (0-2-3)
Semesters Offered: Spring
Pre-Requisite(s): MA 2160(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
Pre-Requisite(s): EET 1120 and (MA 1160(C) or MA 1161(C) or MA 1135(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: 3.0
Lec-Rec-Lab: (0-3-2)
Semesters Offered: Fall
Pre-Requisite(s): EET 1120 or EET 1411

EET 2142 - Digital Design and Modeling Using VHDL
Emphasizes the language concepts of digital systems design using VHDL with emphasis on good design practices and writing verification testbenches. Students will gain valuable hands-on experience writing efficient hardware design code and performing simulations using ModelSim.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Spring
Pre-Requisite(s): EET 2141

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: Spring
Pre-Requisite(s): EET 2120

EET 2233 - Electrical Machinery
Fundamental steady-state analysis of DC, AC polypehase and AC single-phase electrical machines as well as transformers.
Credits: 4.0
Lec-Rec-Lab: (0-3-3)
Semesters Offered: Fall, Summer
Pre-Requisite(s): EET 1411 or EET 2120(C)

EET 2241 - C++ and Matlab 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. Focuses on the basic capabilities of MATLAB and its programming environment.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Fall, Spring
Restrictions: Must be enrolled in one of the following Major(s): Electrical Eng Tech (BS)
Pre-Requisite(s): MA 2160(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 sequential logic circuits, arithmetic circuits, and digital memory.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Major(s): Computer Network & System Admn
Pre-Requisite(s): EET 1411 and (MA 1031(C) or MA 1032(C) or MA 1160(C) or MA 1161(C) or MA 1135(C))

EET 2413 - Data Communications
Introduction to the fundamentals of basic data communication methods. Topics include data transmission, signal encoding techniques, digital data communication techniques, transmission media, and frequency domain analysis.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Fall, Summer
Restrictions: Must be enrolled in one of the following Major(s): Electrical Eng Tech (BS), Computer Network & System Admn
Pre-Requisite(s): EET 1411 or EET 1120

EET 3131 - Instrumentation
An investigation of transducers and where they are used. Topics include signal conditioning, sensitivity, linearity, hysteresis, process measurements, and position, motion and force measurements. Exposure to graphical data acquisition tools such as LabVIEW is incorporated.
Credits: 3.0
Lec-Rec-Lab: (0-2-3)
Semesters Offered: Spring
Pre-Requisite(s): EET 1411 or EET 2220 or PH 2230 or EE 2110 or EE 3010

EET 3141 - Computer Architecture and Design
Computer system components, instruction set design, hardwired control units, arithmetic algorithms/circuits, floating-point operations, introduction to memory and I/O interfaces.
Credits: 4.0
Lec-Rec-Lab: (0-3-3)
Semesters Offered: Fall
Pre-Requisite(s): EET 2241 and EET 2142(C)

EET 3142 - Operating System Concepts
Operating system concepts: memory management, process management, and file management; sample operating systems.
Credits: 3.0
Lec-Rec-Lab: (0-2-3)
Semesters Offered: Spring
Pre-Requisite(s): EET 3141

EET 3143 - Programmable Logic Devices
Emphasizes the concept of design, simulation and implementation of large scale digital systems which incorporate digital devices at all complexity levels.
Credits: 3.0
Lec-Rec-Lab: (0-2-3)
Semesters Offered: Fall, Spring
Pre-Requisite(s): EET 3141
EET 3225 - Special Electronic Devices
An advanced course in the study of linear integrated circuits. Includes op amps, comparators, wave form generators, timers and regulators. Emphasizes practical applications, including the interface of time-continuous measures to the discrete digital world.
Credits: 4.0
Lec-Rec-Lab: (0-3-3)
Semesters Offered: Fall
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 3367 - Communication Systems
Basic course in communication systems. Topics include noise designation and calculation, bandwidth, frequency domain analysis, oscillators, AM/FM analysis, AM/FM transmission and reception, superheterodyne principle, and SSB.
Credits: 4.0
Lec-Rec-Lab: (0-2-3)
Semesters Offered: Fall
Pre-Requisite(s): EET 1411 or (EET 2120 and EET 2141) or EET 2411 or PH 2230 or EE 2110 or EE 3010

EET 3390 - Power Systems
A study of the distribution of electrical power from substations to loads, system components and system performance. Covers basics of power systems and their analysis, the per-unit concept, faults on power circuit interrupting, system instrumentation, and automatic protection system.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): EET 2233

EET 3412 - Introduction to Optical Fiber Communication Systems
Focuses on the basic principles of optical fiber communications, including wave propagation, optical fiber, optical transmitters and receivers, signal processing, analysis of system impairments, and optical networks.
Credits: 3.0
Lec-Rec-Lab: (2-2-2)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Major(s): Electrical Eng Tech (BS), Computer Network & System Admin; Must be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): EET 2413

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 4142 - Digital Signal Processing Applications
Provides students with knowledge in architecture, instruction set, hardware and software development tools associated with a fixed point general purpose DSP. Includes applications of DSP in control of electric drives and power electronic devices.
Credits: 3.0
Lec-Rec-Lab: (0-2-3)
Semesters Offered: Spring
Pre-Requisite(s): EET 3367 and EET 4141

EET 4144 - Real-Time Robotics Systems
Covers the components of a robot system, safety, concepts of a work-cell system, geometry, path control, automation sensors, programming techniques, hardware, and software.
Credits: 4.0
Lec-Rec-Lab: (0-3-3)
Semesters Offered: On Demand
Pre-Requisite(s): EET 1411 or EET 2220 or PH 2230 or EE 2110 or EE 3010

EET 4145 - VLSI Circuits Design
VLSI design methodology; specification of VLSI circuits at various levels of abstraction; design, layout, and computer simulation of circuits; high-level synthesis; design projects.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall - Offered alternate years beginning with the 2009-2010 academic year
Pre-Requisite(s): EET 2220

EET 4146 - Functional Verification of Hardware Design
Techniques for verification of hardware designs; writing testbenches, verifications of increasingly complex hardware systems, circuit designs provided by industry using simulation environments commonly used in industry.
Credits: 3.0
Lec-Rec-Lab: (0-3-2)
Semesters Offered: Fall - Offered alternate years beginning with the 2008-2009 academic year
Pre-Requisite(s): EET 3143

EET 4147 - Industrial Robotic Vision Systems and Advanced Teach Pendant Programming
Procedures for setting up, teaching, testing, and modifying robot vision systems widely used in industrial automation. Introduces advanced Teach Pendant Programming to develop complex scenarios for integrating robots into industrial cells. Advanced TPP requires knowledge from prerequisite EET4144.
Credits: 4.0
Lec-Rec-Lab: (0-3-2)
Semesters Offered: Fall, Summer
Pre-Requisite(s): EET 4144

EET 4253 - LabVIEW Programming for Data Acquisition
An introduction to graphical programming using LabVIEW. Data acquisition and control programs will be written. Transducer utilization and signal conditioning are studied, including handling of noise. DAQ interfaces will be designed, built, and implemented.
Credits: 3.0
Lec-Rec-Lab: (0-2-3)
Semesters Offered: Spring
Pre-Requisite(s): EET 1411 or EET 2220 or EE 2110 or EE 3010 or PH 2230

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 3131 or EET 4253
EET 4365 - In-Vehicle Communication Networks
Focuses on in-vehicle system domains and their requirements, and in-vehicle communication bus Controller Area Networks (CAN) and their related physical layers standards. It also covers LIN, FlexRay, and MOST. In-vehicle network examples, components, and tools are presented.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Spring, Summer
Pre-Requisite(s): EET 1411 or EET 1120 or EE 2111 or EE 3010 or PH 2230

EET 4367 - Wireless Communications
Topics include television systems, wave propagation, antennas, digital communications, wireless communications systems and standards, wireless communications channels, multiple access schemes, modern wireless technologies, wireless channel impairments and techniques to minimize them.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Spring
Pre-Requisite(s): EET 3367 and MA 2160

EET 4368 - Optics Fundamentals for Technologists
Assimilation of optics concepts will prepare the technologist to converse with optical professionals in the workplace whenever consulting might be required. Simulation tools for modeling and laboratory experiments will provide hands-on experience working with practical optical systems.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: On Demand

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 4390 - Power Transmission and Alternative Energy
Concepts of power transmission are examined in detail. Alternative energy sources such as wind, solar, and tidal are discussed. The idea of interconnecting the alternative energy with the transmission grid is also presented.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Pre-Requisite(s): EET 3390

EET 4391 - Power Electronics Fundamentals
Credits: 4.0
Lec-Rec-Lab: (0-3-2)
Semesters Offered: On Demand
Pre-Requisite(s): EET 2220

EET 4460 - Senior Project I
Capstone course phase I, 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
Lec-Rec-Lab: (0-1-2)
Semesters Offered: Fall, Spring, Summer
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore

EET 4480 - Senior Project II
A capstone course phase II, 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: (0-1-2)
Semesters Offered: Fall, Spring, Summer
Restrictions: Must be enrolled in one of the following Class(es): Senior
Pre-Requisite(s): EET 4460

EET 4996 - Special Topics in Electrical Engineering Technology
Selected additional topics of interest in Electrical Engineering Technology based on student and faculty demand and interest. May be a tutorial, seminar, workshop, project, or class study.
Credits: variable to 3.0; Repeatable to a Max of 6
Semesters Offered: On Demand
Restrictions: Permission of instructor required; 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

Kinesiology/Integ Physiology

EH 1000 - Introduction to Exercise Science
Introduction to the fields and career opportunities in the exercise sciences.
Credits: 1.0
Lec-Rec-Lab: (1-0-0)
Semesters Offered: Fall

EH 1010 - Introduction to Sports and Fitness Management
Introduction to the fields and career opportunities in sports and fitness management.
Credits: 1.0
Lec-Rec-Lab: (1-0-0)
Semesters Offered: Fall
EH 1500 - Foundations of Kinesiology
Introduces academic subdisciplines of kinesiology - anatomy, motor behavior, biomechanics, physiology, exercise and the environment, sport nutrition and the mind and brain in exercise. Provides the conceptual framework within which the scientific bases for movement during exercise, sport performance, and other forms of physical activity are studied.
Credits: 3.0
Lec: 3.0
Semesters Offered: Spring

EH 2029 - Outdoor Emergency Care Training (Ski Patrol)
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: 2.0
Lec: 0-0-6
Semesters Offered: Fall

EH 2050 - Sports and Fitness Leadership
Course is designed to help students succeed in leadership principles, effective communication, team work, and introspection. Students will lead, teach, and collaborate with their peers through different assignments and active participation in class.
Credits: 2.0
Lec: 0-0-6
Semesters Offered: Fall

EH 2100 - Principles of Sports Officiating
Theory and practice of officiating various sports common in the community and school setting.
Credits: 3.0
Lec: 1-0-2
Semesters Offered: Fall

EH 2200 - Human Reproductive Health & Development
Examines the biological and behavioral dynamics of human sexuality and sexuality education with the identification and examination of contemporary issues. Emphasis will be placed on sexuality education in schools and the community.
Credits: 3.0
Lec: 3-0-0
Semesters Offered: Fall

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. Cost of Red Cross certification is not included in the tuition and lab fee. A fee can be by the student to the American Red Cross if certification is desired.
Credits: 1.0
Lec: 0-0-1
Semesters Offered: Spring

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). Cost of Red Cross certification is not included in the tuition and lab fee. A fee can be paid by the student to the American Red Cross if certification is desired.
Credits: 1.0
Lec: 1-0-0
Semesters Offered: Spring

EH 2800 - Health Promotion and Wellness
This course emphasizes methods in planning, designing, implementing, and improving health/wellness promotion programs. Client motivation, behavior change, and physical activity for special populations will be addressed.
Credits: 3.0
Lec: 3-0-0
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): EH 1500

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.
Credits: 1.0
Lec: 1-0-0
Semesters Offered: Fall
Restrictions: Permission of department required

EH 3010 - Sports Psychology
Overview of psychological principles and their applications to individuals and groups in sport, exercise and/or therapy. For the laboratory portion, students observe and analyze behaviors in a setting of their choice.
Credits: 3.0
Lec: 2-0-1
Semesters Offered: Fall, Spring, Summer
Pre-Requisite(s): PSY 2000

EH 3020 - Foundations of Coaching
Practical and relevant information appropriate for beginning and experienced interscholastic coaches.
Credits: 3.0
Lec: 2-0-1
Semesters Offered: Fall, Summer

EH 3030 - Methods of Coaching
Students will demonstrate knowledge of skills, tactics, strategies, and sporting principles in coaching sport teams.
Credits: 2.0
Lec: 1-1-0
Semesters Offered: Fall, Spring - Offered alternate years beginning with the 2014-2015 academic year

EH 3050 - Introduction to Athletic Training
Covers first aid, adult CPR, child CPR, and other sport training issues. Students receive appropriate certification cards.
Credits: 3.0
Lec: 2-0-1
Semesters Offered: Fall, Spring, Summer

EH 3070 - Sports Administration
Students will learn skills and competencies of sports management including ethics, marketing, law, finance, information, collegiate, Olympic, professional, youth, campus recreation programs, parks, career opportunities, foundations, and future directions.
Credits: 2.0
Lec: 2-0-0
Semesters Offered: Spring - Offered alternate years beginning with the 2011-2012 academic year
Restrictions: May not be enrolled in one of the following Class(es): Freshman

EH 3080 - Facilities & Events Management
Students will learn about managing sports facilities including risk management, administration of personnel, organization, and administrative efficiency.
Credits: 2.0
Lec: 2-0-0
Semesters Offered: Fall, Spring - Offered alternate years beginning with the 2012-2013 academic year
Restrictions: May not be enrolled in one of the following Class(es): Freshman
EH 3090 - Fitness Operations
This course provides instruction on the management aspects of fitness in health clubs and wellness settings. Topics will include staff training and supervision, scheduling, participant assessment, equipment selection, professional responsibilities, and program review.
Credits: 2.0
Lec-Rec-Lab: (2-0-0)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): EH 1500

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: (2-0-2)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): BL 2020 and BL 2021

EH 3690 - Medical First Responder
The first responder course develops emergency medical skills and knowledge that will enable students to assist people who have sustained injury or sudden illness. As the initial level in pre-hospital care, response includes emergency first aid and patient assessment.
Credits: 1.0
Lec-Rec-Lab: (1-0-0)
Semesters Offered: Fall, Summer
Co-Requisite(s): PE 1690

EH 3700 - Lifetime Fitness
To gain a thorough understanding in all areas of personal fitness through functional anatomy, exercise physiology, health and physical fitness, screening and evaluation, nutrition, weight management, exercise prescription and programming considerations, training instruction, and consideration for special populations.
Credits: 3.0
Lec-Rec-Lab: (2-0-2)
Semesters Offered: Fall, Summer - Offered alternate years beginning with the 2010-2011 academic year

EH 3800 - Strength and Conditioning
Theory and practice in development and administration of comprehensive strength and conditioning programs for both the athlete and individual of any level. Includes knowledge, safety concerns and skill techniques necessary for teaching and administering any strength and conditioning facility.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): BL 2010 and BL 2011

EH 3820 - Personal Training
A pragmatic course of both theory and application in setting up a personal training program for individuals. Includes assessment, techniques, planning, safety and legal issues. Leads toward final preparation to earn certification as a personal trainer.
Credits: 2.0
Lec-Rec-Lab: (1-0-1)
Semesters Offered: Spring
Pre-Requisite(s): BL 2010 and BL 2011

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.
Credits: 1.0
Lec-Rec-Lab: (0-0-2)
Semesters Offered: On Demand

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.
Credits: 2.0
Lec-Rec-Lab: (2-0-0)
Semesters Offered: Spring

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, Summer
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): EH 3010 and EH 3020

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: (2-0-2)
Semesters Offered: Fall, Spring, Summer
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): BL 2940

EH 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
Co-Requisite(s): EH 4211
Pre-Requisite(s): BL 2020 and BL 2021

EH 4211 - Exercise Physiology Laboratory
A companion course to EH4210. 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
Co-Requisite(s): EH 4210

EH 4220 - EKG Interpretation
Course is designed for students who are going to pursue future career related to cardiac rehabilitation, physical therapy and students in the Pre-Med program. Students will learn cardiac electrophysiology, the pathophysiology, the diagnosis, and treatment of cardiac arrhythmias, and related cardiovascular diseases. Class will build bridge between basic sciences and human health.
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 2020 and BL 2021

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EH 4400 - Motor Learning and Control
Designed for upper level undergraduates or graduates, this course will provide the current theories and concepts involved in the processes of motor skill acquisition and performance from a behavioral perspective.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Pre-Requisite(s): EH 1500 and BL 2020

EH 4420 - Motor Development
Designed for upper level undergraduates or graduates, this course will focus on the changes in motor behavior across a life span, and examine the study and practice of fundamental patterns within the context of development theory.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Pre-Requisite(s): EH 1500 and BL 2020

EH 4500 - Biomechanics of Human Movement
An in-depth view of the biomechanical properties of the musculoskeletal system. The course provides detailed analyses of the kinetics of human movement, material properties of the component tissues, and dynamic processes of adaptation to stress and strain of the system.
Credits: 3.0
Lec-Rec-Lab: (2-0-1)
Semesters Offered: Fall
Pre-Requisite(s): BL 2020 and EH 1500 and PH 1110 and PH 1111

EH 4600 - Sports and Fitness Promotions
Development and implementation of marketing plans for sports and fitness businesses. Topics include marketing of sporting events and fitness programs, use of traditional media for promotion, web-based advertising (new media), and business branding.
Credits: 2.0
Lec-Rec-Lab: (2-0-0)
Semesters Offered: Fall - Offered alternate years beginning with the 2011-2012 academic year
Pre-Requisite(s): MKT 3000 or BA 3800

EH 4620 - Legal Issues in Sports and Fitness Management
Review of legal issues that apply to sport and fitness organizations such as liability, risk management, facility concerns, and labor laws. Basic components of the U.S. legal system and guidelines, and rules of the National Collegiate Athletic Association will be covered.
Credits: 2.0
Lec-Rec-Lab: (2-0-0)
Semesters Offered: Fall - Offered alternate years beginning with the 2012-2013 academic year

EH 4700 - Physical Therapy Seminar
Seminar for students who are interested in physical therapy profession. Course will include self-directed learning and group work. Topics may include evidence based medicine, literature review writing and evaluation, healthcare reimbursement, clinical decision making, health screenings, and other current topics.
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, Sophomore
Pre-Requisite(s): BL 2020 and BL 2021

EH 4800 - Internship in Sports and Fitness Management
Empirical experiences in an approved internship site. Provides practical experience in one or more work settings, assisting the upper level student in making an appropriate career choice. Internships must be approved by the department internship coordinator and work 50 hours for each credit earned.
Credits: variable to 12.0; Repeatable to a Max of 12
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of department required; Must be enrolled in one of the following Major(s): Sports and Fitness Management; May not be enrolled in one of the following Class(es): Freshman, Sophomore

EH 4900 - Internship in Exercise Science
Practical and didactic training in Exercise Science in an approved internship site. Provides experience in a variety of exercise science or medical settings. Internships must be approved by the department internship coordinator and work 50 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; Must be enrolled in one of the following Major(s): Exercise Science; May not be enrolled in one of the following Class(es): Freshman, Sophomore

EH 4950 - Special Topics in Physical Activity
Only open to Health and Physical Education majors. Departmental approval necessary.
Credits: variable to 9.0; Repeatable to a Max of 9
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of department required; Must be enrolled in one of the following Major(s): Sports and Fitness Management, Exercise Science

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 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 4995 - Research in Kinesiology
A literature and laboratory research experience in kinesiology that culminates in a written report or oral presentation of the work performed.
Credits: variable to 3.0; Repeatable to a Max of 9
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of department required

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: (0-0-4)
Semesters Offered: Fall
Pre-Requisite(s): (MA 1031(C) or MA 1032(C)) and (Spatial Visualization Score >= 19 or ENG 1002(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, Spring

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. Designed for students with no CAD experience.
Credits: 1.0
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): ENG 1002 or ENG 1100 or ENG 1101
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:** (0-0-4)
**Semesters Offered:** Spring
**Pre-Requisite(s):** ENG 1101 and (MA 1160(C) or MA 1161(C)) and (Spatial Visualization Score >= 19 or ENG 1002(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, Summer
**Pre-Requisite(s):** (MA 1160(C) or MA 1161(C) or MA 2160(C)) and (Spatial Visualization Score >= 19 or ENG 1002(C))

ENG 1102 - Engineering Modeling and Design
Continuation of ENG 1101. 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, Summer
**Pre-Requisite(s):** (MA 1160 or MA 1161 or MA 2160) and (ENG 1101 or ENG 1100) and (Spatial Visualization Score >= 19 or ENG 1002)

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 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. Uses MATLAB.
**Credits:** 4.0
**Lec-Rec-Lab:** (0-4-0)
**Semesters Offered:** Spring
**Restrictions:** May not be enrolled in one of the following Major(s): Mechanical Engineering, Civil Engineering
**Pre-Requisite(s):** MA 2160 and PH 2100 and ENG 1102

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 3200 - Thermodynamics/Fluid Mechanics
Provides engineering students with a unified understanding of 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. Uses MATLAB.
**Credits:** 4.0
**Lec-Rec-Lab:** (0-4-0)
**Semesters Offered:** Fall, Spring
**Pre-Requisite(s):** MA 2160 and CH 1112 or (CH 1150 and CH 1151) and PH 2100 and ENG 1102

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. Uses MATLAB.
**Credits:** 2.0
**Lec-Rec-Lab:** (0-2-0)
**Semesters Offered:** Spring
**Pre-Requisite(s):** PH 2100 and CH 1112 or (CH 1150 and CH 1151) and MA 2160 and ENG 1102

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:** Spring
**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 4421 - Engineering Presentations
Preparation, design, and delivery of engineering presentations. Application of visual and oral presentation skills for engineers. Approaches for effectively conveying technical material to a variety of audiences will be examined through the adaptation of past presentations by participants, as well as the crafting of new ones.
**Credits:** 1.0
**Lec-Rec-Lab:** (0-1-0)
**Semesters Offered:** Spring
**Restrictions:** Must be enrolled in one of the following College(s): College of Engineering; Must be enrolled in one of the following Class(es): Junior, Senior
**Pre-Requisite(s):** ENG 1102

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:** variable to 4.0
**Semesters Offered:** Fall, Spring, Summer
**Restrictions:** May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior

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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: variable to 4.0
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: variable to 4.0
Semesters Offered: Fall, Spring, Summer
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, Summer

ENT 2950 - Enterprise Project Work I
Interdisciplinary teams work as part of an enterprise to address real-world 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, Summer
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 enterprise to address real-world 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, Summer
Restrictions: May not be enrolled in one of the following Class(es): Freshman

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

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 3950 - Enterprise Project Work III
Interdisciplinary teams work as part of an enterprise to address real-world 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, Summer
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior

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 daylong, 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, Spring
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior

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 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 live 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 or (ENG 1001 and ENG 1100)

ENT 3959 - Fundamentals of Six Sigma I
This course introduces tools used for design and process improvement development including lean manufacturing and six sigma.
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 3960 - Enterprise Project Work IV
Interdisciplinary teams work as part of an enterprise to address real-world 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, Summer
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior

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 - Technology Commercialization
Presents fundamentals important to moving technology from idea to market. Topics covered include technology assessment and evaluation, intellectual property protection, competitive analysis, legal agreements and transfers of rights, risk analysis, marketing, business planning, development financing, and company formation.

Credits: 1.0
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Fall, Spring
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior

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 Gantt and PERT/CPM charts; resource management and application of critical chain method; project budgeting and cost estimation; project monitoring, control, evaluation, and termination; and project teams, their structure, and interactions.

Credits: 1.0
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Spring, Summer
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 - Six Sigma II
This course builds upon ENT3959 (Six Sigma I) to further develop six sigma skills and preparation for Green Belt certification.

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 3970 - Enterprise Special Topics
For the development of new, junior-level instructional modules in support of the enterprise.

Credits: 1.0; May be repeated
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Fall, Spring, Summer
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 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 1112 or (CH 1150 and CH 1151)

ENT 3976 - Personal Brand Management
Principles of personal brand management that athletes, entertainers, and successful companies and business leaders employ. Intended to develop the entrepreneurial spirit while cultivating integrity-based leadership skills and enabling students to distinguish and package their skills and abilities in a professional manner. The brand YU life philosophy focuses on planning, time-management, interpersonal skills and communication, and mission statement development, marketing and planning.

Credits: 1.0
Lec-Rec-Lab: (1-0-0)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior

ENT 3980 - Pre-Capstone Enterprise Project Work
Interdisciplinary teams work as part of an enterprise to address real-world design projects or problems. This course is to be taken by third-year or fourth-year enterprise students who have completed the junior-level project work, but are not approved as capstone-ready by their department.

Credits: 1.0; Repeatable to a Max of 2
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Fall, Spring
Restrictions: Permission of instructor required; May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): ENT 3950 and ENT 3960

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ENT 4310 - Practical Scanning Probe Microscopy for Undergraduates
In this course, students will learn the design and fundamental physics behind scanning probe microscopy (SPM) techniques. Laboratories will include basic training in the operation of SPM instruments available at MTU, and the exploration of their capabilities during assigned team projects.
Credits: 1.0
Lec-Rec-Lab: (0-0-3)
Semesters Offered: On Demand - Offered alternate years beginning with the 2010-2011 academic year
Restrictions: Permission of instructor required; May not be enrolled in one of the following Class(es): Freshman

ENT 4900 - Senior Enterprise Project Work I for Non-Engineering Majors
Interdisciplinary teams work as part of an enterprise to address real-world projects or problems of significance to industry, government and communities. Fourth-year students gain experience in defining project objectives and planning strategies to achieve these objectives, and leading teams to accomplish project goals. This course is for non-engineering majors.
Credits: 2.0
Lec-Rec-Lab: (0-0-6)
Semesters Offered: Fall, Spring, Summer
Restrictions: May not be enrolled in one of the following College(s): College of Engineering; Must be enrolled in one of the following Class(es): Senior

ENT 4910 - Senior Enterprise Project Work II for Non-Engineering Majors
Interdisciplinary teams work as part of an enterprise to address real-world projects or problems of significance to industry, government and communities. Fourth-year students gain experience in defining project objectives and planning strategies to achieve these objectives, and leading teams to accomplish project goals. This course is for non-engineering majors.
Credits: 2.0
Lec-Rec-Lab: (0-0-6)
Semesters Offered: Fall, Spring, Summer
Restrictions: May not be enrolled in one of the following College(s): College of Engineering; Must be enrolled in one of the following Class(es): Senior

ENT 4950 - Enterprise Project Work V
Interdisciplinary teams work as part of an enterprise to address real-world 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, Summer
Restrictions: Permission of department required; Must be enrolled in one of the following College(s): College of Engineering; Must be enrolled in one of the following Major(s): Civil Engineering, Chemical Engineering, Software Engineering, Electrical Engineering, Environmental Engineering, Mechanical Engineering, Materials Science and Engrg, Biomedical Engineering, Computer Engineering; Must be enrolled in one of the following Class(es): Senior
Pre-Requisite(s): (BE 3500(C) and BE 3600 and BE 3750 or MEEM 4180) or (CE 3620 or CE 3810 and CE 3331) or CM 4855(C) or (CS 4710 or CS 4711 or CS 4712) or EE 3131 or (EE 3130 and EE 3305) and (EE 4900 or EE 3901) and (EE 3171(C) or EE 3173(C) or EE 3170(C)) or (MEEM 3000(C) and MEEM 3900) or (MY 3110 and MY 3200 and MY 3210 and MY 3300 and MY 3410)

ENT 4951 - Business Plans and Budgeting in the Enterprise
Introduction to the mechanics, dynamics and concepts of the financial budgeting process. Applications of financial concepts is emphasized through the development of basic business plans. Topics and activities include budget preparation, performance assessment, and financial evaluation of projects.
Credits: 1.0
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Major(s): Business Administration; Must be enrolled in one of the following Class(es): Junior, Senior

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.
Credits: 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 enterprise to address real-world 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.
Credits: 2.0
Lec-Rec-Lab: (0-0-6)
Semesters Offered: Fall, Spring, Summer
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.
Credits: 1.0; Repeatable to a Max of 2
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of instructor required; Must be enrolled in one of the following Class(es): Senior
Pre-Requisite(s): ENT 3950 and ENT 3960 and ENT 4950 and ENT 4960

ENT 4970 - Enterprise Special Topics
For the development of new, senior-level instructional modules in support of the 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): Senior

Environmental Engineering

ENVE 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
ENVE 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 2160 and CH 1112 or (CH 1150 and CH 1151)

ENVE 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 2160 and CH 1112 or (CH 1150 and CH 1151)

ENVE 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 2160 and CH 1112 or (CH 1150 and CH 1151)

ENVE 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): (ENVE 3501 or ENVE 3503) and ENVE 3502 and (ENG 3200 or CH 3500 or CH 3501)

ENVE 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): ENVE 3501 or ENVE 3503

ENVE 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): ENVE 3501 or ENVE 3503

ENVE 4506 - Application of Sustainability Principles & Environmental Regulations to Engineering Practice
Study of sustainability, federal and state regulations and policies that govern solid and hazardous waste management, environmental risk of toxic chemicals, life cycle assessment, and green engineering.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): ENVE 3501 or ENVE 3503

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

ENVE 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): (ENVE 3501 or ENVE 3503) and (ENG 3200 or ENG 3507)

ENVE 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): (ENVE 3501 or ENVE 3503) and (ENG 3507 or ENG 3200) and ENVE 4501 and ENVE 4508

ENVE 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

ENVE 4512 - Green Engineering Design for Sustainability
Challenges to sustainability, the role of engineering design in achieving sustainability, the current approach to engineering design (process design, material selection and energy consumption) in the context of infrastructure systems, the principles and application of green engineering.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Pre-Requisite(s): ENVE 4501 and ENVE 4508

ENVE 4513 - Physical Chemical Processes - Drinking Water Treatment
Advanced theory, fundamentals, and application of physical and chemical processes employed in design and operation of drinking water treatment 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): Senior
Pre-Requisite(s): ENVE 4501 and ENVE 4508
ENVE 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: Must be enrolled in one of the following Class(es): Senior Pre-Requisite(s): ENVE 4504 or ENVE 4501 or CH 3510

ENVE 4519 - Transport and Transformation of Organic Pollutants
Assessment of factors controlling environmental fate, distribution, and transformation of organic pollutants. Thermodynamics, equilibrium, and kinetic relationships are used to quantify organic pollutant partitioning and transformations in air, water, and sediments. Use of mass balance equations to quantify pollutant transport.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall - Offered alternate years beginning with the 2010-2011 academic year
Restrictions: Must be enrolled in one of the following Class(es): Senior Pre-Requisite(s): CH 3510 or ENVE 4501(C)

ENVE 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

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

English as a Second Language

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
Restrictions: Must be enrolled in one of the following Major(s): English as a Second Language

ESL 0220 - High Beginning Writing
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: 3.0; May be repeated; Graded Pass/Fail Only
Lec-Rec-Lab: (0-2-3)
Semesters Offered: Fall, Spring
Restrictions: Must be enrolled in one of the following Major(s): English as a Second Language

ESL 0230 - Beginning Listening/Speaking
For students of English as a second language; not for native speakers of English. Emphasis is on understanding. Emphasis is on basic pronunciation and listening comprehension in North American English; includes patterns of rhythm and intonation; and conversation practice.
Credits: 4.0; May be repeated; Graded Pass/Fail Only
Lec-Rec-Lab: (0-3-3)
Semesters Offered: Fall, Spring
Restrictions: Must be enrolled in one of the following Major(s): English as a Second Language

ESL 0310 - Intermediate Reading I
For students of English as a second language, not for native speakers of English. Emphasis is on comprehension of main ideas and structural details, critical-thinking skills and class discussion. Students learn to take notes, outline and summarize.
Credits: 3.0; May be repeated; Graded Pass/Fail Only
Lec-Rec-Lab: (0-2-3)
Semesters Offered: Fall, Spring, Summer
Restrictions: Must be enrolled in one of the following Major(s): English as a Second Language

ESL 0311 - Intermediate Vocabulary I
For students of English a second language; not for native English speakers. The emphasis is on vocabulary acquisition for academic study. Students will learn techniques for understanding vocabulary words from context; analyze lexical roots, prefixes and suffixes; and become familiar with word association mapping and idiomatic expressions.
Credits: 1.0; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Fall, Spring, Summer
Restrictions: Must be enrolled in one of the following Major(s): English as a Second Language

ESL 0320 - Intermediate Writing I
For students of English as a second language, not for native speakers of English. Students work collaboratively on writing tasks of various genres through multiple drafts; emphasizes structural organization, thesis development and syntactical accuracy.
Credits: 3.0; May be repeated; Graded Pass/Fail Only
Lec-Rec-Lab: (0-2-3)
Semesters Offered: Fall, Spring, Summer
Restrictions: Must be enrolled in one of the following Major(s): English as a Second Language

ESL 0330 - Intermediate Listening and Speaking I
For students of English as a second language; not for native speakers of English. Emphasis is on developing oral fluency, skills needed for group work, academic listening strategies and academic presentation skills on familiar, informative topics.
Credits: 3.0; May be repeated; Graded Pass/Fail Only
Lec-Rec-Lab: (0-2-3)
Semesters Offered: Fall, Spring, Summer
Restrictions: Must be enrolled in one of the following Major(s): English as a Second Language

ESL 0340 - Intermediate Communicative Grammar
For students of English as a second language; not for native speakers of English. Using explicit instruction and form-focused activities to develop students' syntactical accuracy; emphasizes various simple, complex and compound structures, verb forms and other grammatical elements.
Credits: 1.0; May be repeated; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Fall, Spring, Summer
Restrictions: Must be enrolled in one of the following Major(s): English as a Second Language
ESL 0350 - Intermediate Reading II
For speakers of English as a second language; not for native speakers of English. This is an intermediate reading course for academically oriented ESL students. This course is designed to further develop effective reading strategies for adapted academic texts of varying lengths.
Credits: 3.0; Graded Pass/Fail Only
Lec-Rec-Lab: (0-2-3)
Semesters Offered: Fall, Spring, Summer
Restrictions: Must be enrolled in one of the following Major(s): English as a Second Language

ESL 0351 - Intermediate Vocabulary II
For students of English as a second language; not for native English speakers. Further emphasis on vocabulary acquisition but with more range and depth than in Intermediate Vocabulary I. Demonstrate understanding of figurative language, word relationships, and nuances in word meanings. Students will improve their ability to understand and correctly use academic vocabulary that is technical and precise, and meant to convey specific ideas, often with reduced context.
Credits: 1.0; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Fall, Spring, Summer
Restrictions: Must be enrolled in one of the following Major(s): English as a Second Language

ESL 0360 - Intermediate Writing II
For students of English as a second language, not for native speakers of English. Students work collaboratively on writing tasks of various genres through multiple drafts; further development on structural organization, thesis development and syntactical accuracy.
Credits: 3.0; Graded Pass/Fail Only
Lec-Rec-Lab: (0-2-3)
Semesters Offered: Fall, Spring, Summer
Restrictions: Must be enrolled in one of the following Major(s): English as a Second Language

ESL 0370 - Intermediate Listening and Speaking II
For students of English as a second language; not for native speakers of English. Further development of oral fluency, skills needed for group work, academic listening strategies, and academic presentation skills on familiar, informative topics.
Credits: 3.0; Graded Pass/Fail Only
Lec-Rec-Lab: (0-2-3)
Semesters Offered: Fall, Spring, Summer
Restrictions: Must be enrolled in one of the following Major(s): English as a Second Language

ESL 0371 - Intermediate Pronunciation II
For students of English as a second language, not native speakers of English. Students work on further improving their comprehensibility of spoken English through in-class instruction and structured lab time. Focus is on rhythm and intonation.
Credits: 1.0; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Fall, Spring, Summer
Restrictions: Must be enrolled in one of the following Major(s): English as a Second Language

ESL 0380 - Intermediate Communicative Grammar II
For students of English as a second language, not for native speakers of English. Using explicit instruction and form-focused activities to develop students’ syntactical accuracy; further developments on various simple, complex and compound structures, verb forms and other grammatical elements.
Credits: 1.0; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Fall, Spring, Summer
Restrictions: Must be enrolled in one of the following Major(s): English as a Second Language

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.
Credits: variable to 6.0; May be repeated; Graded Pass/Fail Only
Semesters Offered: On Demand
Restrictions: Must be enrolled in one of the following Major(s): English as a Second Language

ESL 0398 - SMILE: Summer Intensive Language Experience
For students of English as a second language; not for native speakers of English. An Intermediate Level, multiple skills course in reading/vocabulary, writing/grammar, listening/speaking, and American culture.
Credits: 6.0; Graded Pass/Fail Only
Lec-Rec-Lab: (0-4-5)
Semesters Offered: Summer
Restrictions: Must be enrolled in one of the following Major(s): English as a Second Language

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
Restrictions: Must be enrolled in one of the following Major(s): English as a Second Language

ESL 0410 - Advanced Reading I
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, note-taking, inferring, summarizing, critical thinking and discussion.
Credits: 3.0; May be repeated; Graded Pass/Fail Only
Lec-Rec-Lab: (0-2-3)
Semesters Offered: Fall, Spring, Summer
Restrictions: Must be enrolled in one of the following Major(s): English as a Second Language

ESL 0411 - Advanced Vocabulary I
For students of English as a second language; not for native speakers of English. Emphasis is on helping students increase their command of idiomatic English and academic vocabulary in daily and academic situations with attention given to correct pronunciation. Additional practice with the Academic Word List (AWL) will include short writing assignments.
Credits: 1.0; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Fall, Spring, Summer
Restrictions: Must be enrolled in one of the following Major(s): English as a Second Language

ESL 0412 - Advanced English for Business
This course is designed for students of English as a second language, not for native speakers of English. Emphasis is on acquiring vocabulary necessary for academic study of courses required in business majors.
Credits: 1.0; May be repeated; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring
Restrictions: Must be enrolled in one of the following Major(s): English as a Second Language

ESL 0413 - Advanced English for Engineering
This course is designed for students of English as a second language, not for native speakers of English. Emphasis is on acquiring vocabulary necessary for academic study of courses required in engineering majors.
Credits: 1.0; May be repeated; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring
Restrictions: Must be enrolled in one of the following Major(s): English as a Second Language
ESL 0414 - Advanced English for Math
This course is designed for students of English as a second language, not for native speakers of English. Emphasis is on acquiring vocabulary necessary for academic study of mathematic courses.
Credits: 1.0; May be repeated; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring
Restrictions: Must be enrolled in one of the following Major(s): English as a Second Language

ESL 0415 - Advanced English for Science
This course is designed for students of English as a second language, not for native speakers of English. Emphasis is on acquiring vocabulary necessary for academic study of courses required in biological science majors.
Credits: 1.0; May be repeated; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring, Summer
Restrictions: Must be enrolled in one of the following Major(s): English as a Second Language

ESL 0420 - Advanced Writing I
For students of English as a second language, not for native speakers of English. Students work collaboratively on writing tasks of various genres through multiple drafts; emphasizes coherence and unity, source use and documentation and language formality.
Credits: 3.0; May be repeated; Graded Pass/Fail Only
Lec-Rec-Lab: (0-2-3)
Semesters Offered: Fall, Spring, Summer
Restrictions: Must be enrolled in one of the following Major(s): English as a Second Language

ESL 0430 - Advanced Listening and Speaking I
For students of English as a second language; not for native speakers of English. Emphasis is on developing oral fluency academic listening strategies, argument development, skills needed for group work and academic presentation skills with a focus on persuasive speaking.
Credits: 3.0; May be repeated; Graded Pass/Fail Only
Lec-Rec-Lab: (0-2-3)
Semesters Offered: Fall, Spring, Summer
Restrictions: Must be enrolled in one of the following Major(s): English as a Second Language

ESL 0431 - Advanced Pronunciation I
For students of English as a second language, not native speakers of English. Emphasis is on explicit, contextualized pronunciation instruction with the goal of improving student comprehensibility. Focus is on segmental articulation. Time is split between classroom instruction and lab.
Credits: 1.0; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Fall, Spring, Summer
Restrictions: Must be enrolled in one of the following Major(s): English as a Second Language

ESL 0440 - Advanced Communicative Grammar I
For students of English as a second language; not for native speakers of English. Using explicit instruction, and form-focused activities to develop students' error analysis skills; emphasizes correcting sentence constructions and connections, verb consistency and other common errors.
Credits: 1.0; May be repeated; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Fall, Spring, Summer
Restrictions: Must be enrolled in one of the following Major(s): English as a Second Language

ESL 0450 - Advanced Reading II
For students of English as a second language, not for native speakers of English. Emphasis is on mastering the words and phrases that are specific to academic writing, speaking and research, as well as everyday idioms, expressions, and abbreviations. Predicting the pronunciation pattern of new words and phrases; lexical bundles and collocation usage will be also covered.
Credits: 1.0; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Fall, Spring, Summer
Restrictions: Must be enrolled in one of the following Major(s): English as a Second Language

ESL 0451 - Advanced Vocabulary II
For students of English as a second language, not for native speakers of English. Emphasis is on mastering the words and phrases that are specific to academic writing, speaking and research, as well as everyday idioms, expressions, and abbreviations. Predicting the pronunciation pattern of new words and phrases; lexical bundles and collocation usage will be also covered.
Credits: 1.0; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Fall, Spring, Summer
Restrictions: Must be enrolled in one of the following Major(s): English as a Second Language

ESL 0460 - Advanced Writing II
For students of English as a second language, not for native speakers of English. Students work collaboratively on writing tasks of various genres through multiple drafts; further development on coherence and unity, source use and documentation and language formality.
Credits: 3.0; Graded Pass/Fail Only
Lec-Rec-Lab: (0-2-3)
Semesters Offered: Fall, Spring, Summer
Restrictions: Must be enrolled in one of the following Major(s): English as a Second Language

ESL 0470 - Advanced Listening and Speaking II
For students of English as a second language, not for native speakers of English. Further development of oral fluency, academic listening strategies, argument development, skills needed for group work, and academic presentation skills with a focus on persuasive speaking.
Credits: 3.0; Graded Pass/Fail Only
Lec-Rec-Lab: (0-2-3)
Semesters Offered: Fall, Spring, Summer
Restrictions: Must be enrolled in one of the following Major(s): English as a Second Language

ESL 0471 - Advanced Pronunciation II
For students of English as a second language, not native speakers of English. Students work on further improving their comprehensibility of spoken English through in-class instruction and structured lab time. Focus is on segmental elements and articulation.
Credits: 1.0; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Fall, Spring, Summer
Restrictions: Must be enrolled in one of the following Major(s): English as a Second Language

ESL 0480 - Advanced Communicative Grammar II
For students of English as a second language, not native speakers of English. Using explicit instruction and form-focused activities to develop students' error analysis skills; further development on correcting sentence constructions and connections, verb consistency and other common errors.
Credits: 1.0; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Fall, Spring, Summer
Restrictions: Must be enrolled in one of the following Major(s): English as a Second Language
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 6.0; May be repeated; Graded Pass/Fail Only  
Semesters Offered: On Demand  
Restrictions: Must be enrolled in one of the following Major(s): English as a Second Language  

ESL 0491 - Transitional Writing
For students of English as a second language, not for native speakers of English. Students work collaboratively on writing tasks of various genres through multiple drafts; emphasizes argument construction/deconstruction, source integration, sentence variety and cohesion.  
Credits: 3.0; May be repeated; Graded Pass/Fail Only  
Lec-Rec-Lab: (0-2-3)  
Semesters Offered: Fall, Spring, Summer  
Restrictions: Must be enrolled in one of the following Major(s): English as a Second Language  

ESL 0492 - Transitional Listening and Speaking
For students of English as a second language, not for native speakers of English. Emphasis is on developing oral fluency, academic listening strategies, research skills, skills needed for group work and academic presentation skills with a focus on academic research projects.  
Credits: 3.0; May be repeated; Graded Pass/Fail Only  
Lec-Rec-Lab: (0-2-3)  
Semesters Offered: Fall, Spring, Summer  
Restrictions: Must be enrolled in one of the following Major(s): English as a Second Language  

ESL 0493 - Transitional Reading and Vocabulary
For students in English as a second language, not for native speakers of English. This course emphasizes the continued acquisition of higher level reading skills needed for university courses, expansion of receptive and productive academic vocabulary, comprehension of authentic American university texts as well as other authentic reading materials of varying lengths.  
Credits: 3.0; Graded Pass/Fail Only  
Lec-Rec-Lab: (0-2-3)  
Semesters Offered: Fall, Spring, Summer  
Restrictions: Must be enrolled in one of the following Major(s): English as a Second Language  

ESL 0495 - TOEFL Preparation
This course is designed for students of English as a second language, not for native speakers of English. Emphasis is on the English used in colleges and universities in preparation for taking the IBT, the internet-based TOEFL (Test of English as a Foreign Language).  
Credits: 1.0; May be repeated; Graded Pass/Fail Only  
Lec-Rec-Lab: (0-0-2)  
Semesters Offered: Fall, Spring  
Restrictions: Must be enrolled in one of the following Major(s): English as a Second Language  

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. Offered second half of summer semester.  
Credits: 6.0; Graded Pass/Fail Only  
Lec-Rec-Lab: (0-4-5)  
Semesters Offered: Summer  
Restrictions: Must be enrolled in one of the following Major(s): English as a Second Language  

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: On Demand  
Restrictions: Must be enrolled in one of the following Major(s): English as a Second Language  

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: Must be enrolled in one of the following Major(s): English as a Second Language; May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior  

ESL 0560 - Research Writing I
For international graduate students of English as a second language, not for native speakers of English. Students work on improving academic reading and writing skills; emphasizes rhetorical analysis, cohesion and coherence, source use, research skills and syntactical accuracy.  
Credits: 3.0; Graded Pass/Fail Only  
Lec-Rec-Lab: (0-2-3)  
Semesters Offered: Fall  

ESL 0580 - Research Writing II
For international graduate students of English as a second language, not for native speakers of English. Students work on improving academic reading and writing skills; emphasizes graduate research writing and academic presentations.  
Credits: 3.0; Graded Pass/Fail Only  
Lec-Rec-Lab: (0-2-3)  
Semesters Offered: Spring  

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: Must be enrolled in one of the following Major(s): English as a Second Language; 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, Summer  
Restrictions: Must be enrolled in one of the following Major(s): English as a Second Language  

Visual and Performing Arts

FA 1660 - Introductory Acting Practicum
Introductory level course intended to introduce performance students to the professional performance process in film, video, or stage production. Students must audition for and be cast in an approved production.  
Credits: 1.0  
Lec-Rec-Lab: (0-0-1)  
Semesters Offered: Fall, Spring  
Restrictions: Permission of instructor required
FA 1662 - Introduction to Audio Production
An introduction to hands-on creative and technical work in sound. Work covers script analysis, story telling approaches, dialogue direction and editing, sound effect and ambiance design, music integration and DAW based mixing.
Credits: 1.0
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall

FA 1664 - Introduction to Music Mixing
A hands-on introduction to mixing music with emphasis on the support of musical principles and style. Students develop a technical understanding of and practice the manipulation of volume, frequency, dynamics, pitch, and time to support the focus, rhythm, melody, and mood of a wide variety of musical styles.
Credits: 1.0
Lec-Rec-Lab: (0-0-2)
Semesters Offered: 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, Spring

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: Fall, Spring

FA 1703 - Costume Technology
Introduction to basics of costume shop technology, costume construction/sewing. Focus on costume shop procedures, practical use of tools, machines, and techniques through individual projects and costuming for mainstage productions. Overview of hand sewing, pattern drafting, and pattern fitting/alteration.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall

FA 2050 - Drawing I
Exploration and practice of fundamental principles of drawing. Develops skills in representational drawing, perspective, and composition. Develops creative and modern drawing techniques using a wide range of subject matter. Multi-media presentations and discussions illustrate classic principles while encouraging development of individual expression.
Credits: 3.0
Lec-Rec-Lab: (0-0-4)
Semesters Offered: Fall, Summer

FA 2080 - Presentation Skills
A study and practice of delivery skills in the communication process. Students strengthen communication skills on all levels from interpersonal to public speaking.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring, Summer

FA 2112 - Creating Music
Explores the art of contemporary acoustic and electronic composition providing students with hands on opportunities to study and create music.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, 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: (0-0-4)
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: (0-0-4)
Semesters Offered: Fall, Summer

FA 2222 - Film Music
This course surveys the development of film music. Students will learn how music functions to support the aesthetic/narrative elements of the story. Students will learn skills to identify how music manipulates the listener and how composers shape that manipulation.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Summer

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: (0-0-4)
Semesters Offered: Fall

FA 2305 - Ceramics I
Introduces handbuilding ceramic techniques, including coil, slab and pinch construction. The goal is to allow students to be individually creative through experimenting with the possibilities in three-dimensional form.
Credits: 3.0
Lec-Rec-Lab: (0-0-4)
Semesters Offered: Fall

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: On Demand

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. May be used once as a general education co-curricular course.
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. May be used once as a general education co-curricular course.
Credits: 1.0; May be repeated; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Spring

FA 2430 - 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 2500 - Basic Musicianship: Skill Acquisition in Music Reading, Sight-Singing, and Ear-Training
Skill acquisition in music reading, sight-singing, ear-training, conducting and formal analysis. Introduction to melodic and rhythmic performance systems. An aural reinforcement of concepts taught in FA2500.
Credits: 2.0
Lec-Rec-Lab: (0-1-2)
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 2570 - Music Lessons for Brass, Woodwind, String, Percussion, Harp, Piano, Voice, Guitar
Private music instruction on brass, woodwind, string, and percussion instruments, and harp, piano, voice, and guitar. Separate course fee required. One semester may be counted toward General Education Co-Curricular requirements. After enrolling, email lessons@mtu.edu.
Credits: 0.5; May be repeated; Graded Pass/Fall Only
Lec-Rec-Lab: (0-0-1)
Semesters Offered: Fall, Spring, Summer

FA 2600 - Acting I
Teaches basic techniques of acting to include script and character analysis, internal and external approaches to performance, and basic use of voice and body.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring, Summer

FA 2610 - Acting II: Scene Study
An advanced studio course designed to permit application of various acting techniques. Students will learn to combine acting skills and script analysis to develop multidimensional characters.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): FA 2600

FA 2640 - Stage Makeup
A practical guide to the theory and practice of makeup for the stage. Students will study basic techniques including corrective, aging, character makeup, and special effects.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall - Offered alternate years beginning with the 2009-2010 academic year

FA 2650 - Audition Techniques
Students learn to prepare for the many types of auditions they may encounter in the professional world of performance through simulated audition situations, from the theatrical cattle-call to the screen test in film.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2009-2010 academic year
Pre-Requisite(s): FA 2600

FA 2660 - Acting Practicum
Students selected to be members of the cast or to serve as assistant directors or stage managers for plays produced by the Department of Visual and Performing 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, Summer
Restrictions: Permission of instructor required

FA 2661 - Backstage Practicum
Open to students selected for the crew of a mainstage theatre production sponsored by the Department of Visual and Performing Arts. Positions on stage crews are open to all MTU students. Work assignments will be made by the technical director of the Department of Visual and Performing Arts.
Credits: variable to 3.0; May be repeated
Semesters Offered: Fall, Spring

FA 2662 - Sound Practicum
Students get hands-on experience working in live and recorded sound as well as in system maintenance and design. This work is done in simulated internship experience. Students are expected to take this course multiple times and work towards leadership positions.
Credits: variable to 3.0; May be repeated
Semesters Offered: Fall, Spring
Pre-Requisite(s): FA 1702 and (FA 1662 or FA 1664)

FA 2663 - Career Development
Provides students the opportunity to attend professional events which contribute to the development of their careers. Students will experience seminars, workshops, performance opportunities, competitions, and may perform services and interact with professionals at such events as KCACTF, AES, USITT, and URTA.
Credits: 1.0; Repeatable to a Max of 6
Lec-Rec-Lab: (0-0-1)
Semesters Offered: Fall, Spring
Restrictions: Must be enrolled in one of the following Major(s): Sound Design, Theatre & Entertain Tech (BS), Theatre & Electr. Media Perf., Audio Production & Technology
FA 2701 - Drafting for the Entertainment Industry
Basics of hand drafting conventions and standards used in the entertainment industry. Focus on design and technical techniques for views such as: ground plans, elevations, sections, detail drawings, orthographic projections, scale perspective drawings. Introduces industry-specific CAD programs.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring, Summer

FA 2710 - Movement for Performers
Develops physical flexibility and strength, beginning with discovery of the body’s physical center. The student will learn to create characters by focusing on posture, movement in space, and kinesics.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall - Offered alternate years beginning with the 2009-2010 academic year

FA 2720 - Audio Arts Appreciation
Overview of sound: engagement with critical, historical, and creative approaches to sound in Film, Television, Theatre, Art, and Music. Integrated with a historical overview of aural environment and attempts to design environment from zen gardens to Harley exhaust.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2014-2015 academic year

FA 2820 - Theatre Appreciation
Survey of the nature of theatre from the classics to the twentieth century, emphasizing procedures of play production. Includes the roles of playwright, actor, director, and designer, and examines theories of modern theatre production.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring

FA 2830 - Voice and Articulation
An applied study of the use of voice. Students will work to develop a stronger, more articulate and dialect-free speech appropriate for professional careers. Spring course offering will be in alternate years beginning with Spring 2009.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring - Offered alternate years beginning with the 2010-2011 academic year

FA 3000 - Visual & Performing 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 3112 - Music Composition I: Techniques of Contemporary Composition
This course is a study in the art of acoustic instrumental, vocal and MIDI composition. Students will study music of contemporary composers and create compositions for performance.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): FA 2500 and FA 3530

FA 3122 - Composition II: Music for Media
This course is a continuation of Music Composition I. Students expand their skills to include composition for media including, film, television, and digital arts. Students will apply their skills to create fully realized live performances of their compositions.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): FA 2500 and FA 3530 and FA 3112

FA 3133 - Contemporary Music: The Search for New Sounds
Contemporary Music will explore music from the late nineteenth century through today. The focus of the class will be modern composers’ search for new sounds using electronic instruments, popular music, non-western music, and new performance techniques.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2013-2014 academic year
Pre-Requisite(s): FA 2500

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: (0-0-4)
Semesters Offered: Spring
Pre-Requisite(s): FA 2050 or FA 2150

FA 3200 - Creative Watermedia
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: (0-0-4)
Semesters Offered: Spring, Summer

FA 3300 - Three-Dimensional Design
Introduction to three-dimensional design concepts. Students create 3-D objects based on 2-D ideations. Learn vocabulary and aesthetics related to 3D design and how they apply to contemporary design.
Credits: 3.0
Lec-Rec-Lab: (0-0-4)
Semesters Offered: Fall
Pre-Requisite(s): UN 1002 or UN 1003

FA 3305 - Creative Ceramics
Addresses ceramic theory, history, and science, and aims to develop the content and quality of students’ work in clay. Students will learn new ways of creating forms through use of the wheel, molds, and study of clay and glaze technologies.
Credits: 3.0
Lec-Rec-Lab: (0-0-4)
Semesters Offered: Spring, Summer

FA 3330 - Art History - Prehistory to Renaissance
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
Pre-Requisite(s): UN 1002 or UN 1003
FA 3333 - Sculpture
Theory, tools, and media of sculpture. Focuses primarily on wood, 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: (0-0-4)
Semesters Offered: On Demand

FA 3335 - Sculpture II
Explores the material properties and expressive potential of plaster, clay, and found objects, approaching sculpture from the perspective of contemporary practices. Increases knowledge of traditional materials and techniques while encouraging students to experiment with new processes.
Credits: 3.0
Lec-Rec-Lab: (0-0-4)
Semesters Offered: On Demand
Pre-Requisite(s): FA 3333

FA 3340 - Art History - Renaissance to Today
Survey of art in the Western world from the Renaissance to the 21st 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
Pre-Requisite(s): UN 1002 or UN 1003

FA 3360 - Ceramic Sculpture
Explores the material properties and expressive potential of clay. Learning a variety of sculptured techniques, students will demonstrate the ability to incorporate the elements and principles of art (line, space, form, harmony) to create aesthetic artwork.
Credits: 3.0
Lec-Rec-Lab: (0-0-4)
Semesters Offered: Fall
Pre-Requisite(s): FA 2305 or FA 3305

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
Pre-Requisite(s): FA 2305 or FA 3305

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
Restrictions: Permission of instructor required

FA 3430 - 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 3501 - Advanced Musicianship: Score Reading, Conducting Technique, Ear-Training, and Musicianship
Fluency in reading, analyzing, and interpreting orchestral, band, and choral music scores; principles and techniques of conducting a music ensemble; live conducting experiences with music ensembles; in-depth analysis of live and recorded classical, jazz, and rock music; fundamentals of musicianship.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring
Pre-Requisite(s): FA 2500

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, Summer

FA 3520 - Music Perception: Why Does Music Work?
This course explores the human perception of music and sound from the perspectives of psychology, physiology, and aesthetics. Topics include: musical analysis, evaluation of music, and historical contexts.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring, Summer - Offered alternate years beginning with the 2010-2011 academic year
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): FA 2500

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, Summer
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 - Offered alternate years beginning with the 2009-2010 academic year
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 3565 - Masterworks in Western Music Literature
Examination of selected works from the canon of Western Music in context of relevant historical events. Students will explore the relation of text and music, ritual and music, rhetorical tropes in music as well as expressions of musical form.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall - Offered alternate years beginning with the 2013-2014 academic year
Pre-Requisite(s): FA 2500(C) or FA 2501(C)

FA 3580 - Chamber Choir
Participation in the Chamber Choir provides opportunities for students to explore and perform music written for small choir. Repertoire from varied styles and time periods (from antiquity to the present) will be prepared and presented in formal and informal performance settings. Audition required.
Credits: 1.0; May be repeated
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Fall, Spring

FA 3620 - Acting for Television and Film
Advanced applications of fundamental acting technique and presentation skills with the added dynamic of the camera. Students will explore scene work for television and film, as well as commercial performance techniques for advertising in digital media.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2013-2014 academic year
Pre-Requisite(s): FA 2080(C) and FA 2600

FA 3625 - History of Rock
This course will acquaint the student with the musical, historical, cultural, and sociological elements of Rock Music. It covers the major stylistic eras from 1948 - present, the "pre-rock" era and the major artists and their contributions. Emphasis is placed on students developing interactive, aural and critical skills.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Summer

FA 3630 - The Beatles and the Beach Boys: An Analysis of Their Music, Their Evolution, Their Rivalry
Analysis of biography, formative vs. mature style, musical structure, and historical impact of both bands. Offered online, second half of summer term.
Credits: 3.0
Lec-Rec-Lab: (2-0-1)
Semesters Offered: Summer

FA 3650 - Stage Management
Procedures and skills for effective stage 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 2009-2010 academic year
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): FA 1701 and FA 1702

FA 3661 - Design & Management Practicum
Open to students who take significant responsibility for a Visual and Performing Arts production, such as stage manager, assistant designer, or assistant director.
Credits: variable to 3.0; May be repeated
Semesters Offered: Fall, Spring
Pre-Requisite(s): FA 2661

FA 3662 - Advanced Sound Practicum
Open to students who take significant responsibility for sound on a major 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
Pre-Requisite(s): FA 1662 and FA 1664 and FA 1702 and FA 2662 and FA 3730

FA 3663 - Professional Presentation
Provides students the opportunity to present at professional events which contribute to the development of their careers. Students will prepare and present design, technical, or performance projects, papers, and/or posters to be viewed and critiqued by professionals at such events as KCACTF, AES, USITT, and URTA.
Credits: 1.0; Repeatable to a Max of 4
Lec-Rec-Lab: (0-0-1)
Semesters Offered: Fall, Spring
Pre-Requisite(s): FA 3700(C) or FA 3730(C) or FA 3750(C) or FA 3760(C)

FA 3680 - Period Acting Styles
Provides knowledge and experience in playing the manners, movement, and language in plays of the most frequently performed periods.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2008-2009 academic year
Pre-Requisite(s): FA 2600 and FA 2610

FA 3700 - Scenic Design
Fundamentals of designing theatrical scenery through various explorations and projects. Focus on professional design development and presentation techniques: theatrical drafting conventions, renderings, scale models. Also, designer/director relationships, script analysis, research design concepts/history/styles. Students are introduced to a mainstream theatre design.
Credits: 3.0
Lec-Rec-Lab: (3-0-3)
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): FA 1701

FA 3701 - Advanced Backstage Technology
Techniques, theories, and terminology of technical theatre. Focus on practical application of advanced stagecraft through safety, woodworking, metalworking, budgeting, project management, and shop management.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall - Offered alternate years beginning with the 2011-2012 academic year
Pre-Requisite(s): FA 1701

FA 3710 - Vocal Approaches for Theatre and Electronic Media
Students will learn vocal approaches to specific types of speaking situations, including radio commercials, instructional videos, announcing cartoons, and theatrical productions. Students will practice vocal projection for a large theatre/auditorium, as well as microphone technique for electronic media.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2008-2009 academic year
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): FA 1662 and FA 1664 and FA 1702

FA 3731 - Live Sound Design Intensive
Students design, install, program, run, and record a major live production. Sound will be an essential part of the story telling experience requiring a close relationship with the actors and extensive integration with other design elements.
Credits: 1.0
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Major(s): Sound Design, Theatre & Entertain Tech (BS), Theatre & Electr. Media Perf., Audio Production & Technology; May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): FA 1662 and FA 1664 and FA 1702 and FA 2662 and FA 3730

FA 3732 - Audio Creative Lab
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; Repeatable to a Max of 4
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): FA 1662 and FA 1664 and FA 1702 and FA 2662 and FA 3730

FA 3735 - Music, Film, and Theatre Sound
Explores the ambient acoustic environment of everyday life and popular culture, including how sound is used to manipulate emotions and thoughts. Students will learn to analyze sound and develop competence in creating artistically motivated sounds.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Summer
Pre-Requisite(s): UN 1002 or UN 1003

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, Summer
Restrictions: Must be enrolled in one of the following Major(s): Sound Design, Theatre & Entertain Tech (BS), Theatre & Electr. Media Perf., Audio Production & Technology
Pre-Requisite(s): FA 1662 and FA 1664 and FA 1702

FA 3750 - Lighting Design
Fundamentals of designing theatrical lighting through various explorations and projects. Focus on professional design development and presentation techniques: theatrical drafting conventions, light sketches, plots. Also, designer/director relationships, script analysis, research, design concepts/history. Students are introduced to a mainstage theatre design.
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): FA 1702

FA 3760 - Costume Design
Fundamentals of designing theatrical costumes through various explorations and projects. Focus on professional design development and presentation techniques: costume renderings, patterning, color/fabric analysis. Also, designer/director relationships, script/character analyses, research, design concepts. Students are introduced to a mainstage theatre design.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
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

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
Restrictions: Permission of instructor required
Pre-Requisite(s): FA 2800 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: Fall

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

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: On Demand
Pre-Requisite(s): UN 1002 or UN 1003
FA 3860 - Costume History
A study of costume fashion, emphasis on the western world, from antiquity through the 20th Century. Including: basic characteristics of each period, environmental & cultural influences, specific costume terminology. Comparative analysis of historic costume choices found in film & theatre.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall - Offered alternate years beginning with the 2012-2013 academic year

FA 3880 - Readings in Dramatic Literature
An examination of dramatic literature with an emphasis on theatre production. Students will examine a selection of plays each semester. Students can repeat the course up to four times; each semester examines different plays.
Credits: 1.0; Repeatable to a Max of 4
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Fall, Spring, Summer
Restrictions: Must be enrolled in one of the following Major(s): Theatre & Entertain Tech (BA), Theatre & Entertain Tech (BS), Sound Design, Theatre & Electr. Media Perf., Audio Production & Technology; May not be enrolled in one of the following Class(es): Freshman

FA 3975 - Portfolio Development
Techniques for building and presenting an electronic and hardcopy design and technical professional portfolio for the theatre and entertainment industry. The final result of the course will be a portfolio of all work to date.
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

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 2050 or 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 2200 or 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: On Demand
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 4620 - Musical Theatre Performance
Provides specialized experience in performance styles of the musical theatre through scene-study and process from sheet music to the stage.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2009-2010 academic year
Pre-Requisite(s): FA 2600

FA 4701 - Stage Mechanics and Rigging
Practical application and theory of stage mechanics and rigging. Emphasis will be placed on theatrical systems such as line-sets, turntables, and scenery lifts. Course will also explore automation through pneumatics, hydraulics, and motor control.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall - Offered alternate years beginning with the 2010-2011 academic year
Pre-Requisite(s): FA 1701

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 environment.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Major(s): Theatre & Entertain Tech (BS), Sound Design, Audio Production & Technology
Co-Requisite(s): FA 4741
Pre-Requisite(s): FA 1702 and FA 2662 and FA 3730 and PH 1090

FA 4741 - Transducer Theory Lab
Laboratory to practice the application of loudspeaker and microphone principles. Designed to be taken concurrently with FA4740 Transducer Theory.
Credits: 1.0
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Major(s): Theatre & Entertain Tech (BS), Sound Design, Audio Production & Technology
Co-Requisite(s): FA 4740
**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

**Semesters Offered:** Fall - 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 in Visual and Performing Arts**
Independent research directed by Visual and Performing Arts faculty. Projects focus on one or more of the visual and performing genres: theatre, music, visual art. Requires a written proposal setting out goals, plans for final project, and the resources required to complete the project.

**Credits:** variable to 3.0; May be repeated

**Semesters Offered:** Fall, Spring, Summer

**Restrictions:** Permission of instructor required

**Pre-Requisite(s):** FA 2500 or BA 2300 or UN 1002 or UN 1003

**FA 4950 - Special Topics in Visual & Performing Arts**
Tutorial, seminar, or class study of a topic of special interest and importance in visual and performing arts.

**Credits:** variable to 3.0; May be repeated

**Semesters Offered:** On Demand

**Restrictions:** Permission of instructor required

**FA 4970 - Visual and Performing 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 Visual and Performing 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

**Pre-Requisite(s):** FA 4970

**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 Visual and Performing Arts faculty advisor before the student enrolls in FA4972.

**Credits:** variable to 3.0; Repeatable to a Max of 6

**Semesters Offered:** Fall, Spring

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

**Pre-Requisite(s):** FA 4972

**FA 4975 - Portfolio Presentation**
A public presentation of an array of art work completed by a student as part of the minor in Art or a Visual and Performing Arts degree program. Guidelines for the portfolio presentation are available from the student's advisor.

**Credits:** variable to 3.0; Repeatable to a Max of 3

**Semesters Offered:** Fall, Spring, Summer

**Restrictions:** Permission of instructor required

**Finance**

**FIN 3000 - Principles of Finance**
Introduction to the principles of finance. Topics include financial mathematics, the capital investment decision, financial assets valuation, and the risk-return relationship.

**Credits:** 3.0

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

**Semesters Offered:** Fall, Spring, Summer

**Pre-Requisite(s):** (MA 2710 or MA 2720 or MA 3710 or BUS 2100 or BA 2100) and (ACC 2100(C) or BA 2310 or BA 2340)

**FIN 4000 - Investment Analysis**

**Credits:** 3.0

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

**Semesters Offered:** Spring

**Pre-Requisite(s):** BA 3400 or EC 3400 or FIN 3000

**FIN 4100 - Advanced Financial Management**
Advanced topics in managerial finance: Advanced capital budgeting, project analysis, capital acquisition, capital structure and dividend policy, and other topics.

**Credits:** 3.0

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

**Semesters Offered:** Fall

**Pre-Requisite(s):** BA 3400 or EC 3400 or FIN 3000

**FIN 4200 - 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 or EC 3400 or FIN 3000

**FIN 4300 - Personal Financial Planning**
Overview of personal financial issues and services and instruments offered by economic and financial institutions. Topics include the personal financial environment, 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 or FIN 3000

**FIN 4400 - Security Analysis**
Detailed analysis of security valuation. Topics include fundamental analysis (financial statement analysis, free cash flow valuation, credit analysis, ratio analysis), technical analysis, and quantitative analysis.

**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):** FIN 3000 or BA 3400 or EC 3400

**FIN 4500 - Financial Risk Management and Financial Engineering**
Detailed analysis of the measurement of financial risk and the tools and techniques available to manage financial risk. Topics include financial disasters, risk measurement (market, default, currency exchange, value-at-risk) and the hedging of these risks.

**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):** FIN 3000 or BA 3400 or EC 3400

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FIN 4700 - 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: Fall  
Pre-Requisite(s): BA 3400 or EC 3400 or FIN 3000

FIN 4801 - Applied Portfolio Management I  
Covers issues in the management and administration of investments in an institutional setting. Students form a new investment firm and manage a real portfolio of financial assets.  
Credits: variable to 3.0  
Semesters Offered: Summer  
Restrictions: Permission of instructor required; May not be enrolled in one of the following Class(es): Freshman, Sophomore

FIN 4802 - Applied Portfolio Management II  
Covers issues in the management and administration of investments in an institutional setting. Students form a new investment firm and manage a real portfolio of financial assets.  
Credits: variable to 3.0  
Semesters Offered: Fall  
Restrictions: Permission of instructor required; May not be enrolled in one of the following Class(es): Freshman, Sophomore

FIN 4803 - Applied Portfolio Management III  
Covers issues in the management and administration of investments in an institutional setting. Students form a new investment firm and manage a real portfolio of financial assets.  
Credits: variable to 3.0  
Semesters Offered: Spring  
Restrictions: Permission of instructor required; May not be enrolled in one of the following Class(es): Freshman, Sophomore

FIN 4990 - Special Topics in Finance  
Examines current issues in Finance and other topics of interest to faculty and students in greater depth.  
Credits: variable to 3.0; Repeatable to a Max of 6  
Semesters Offered: On Demand  
Pre-Requisite(s): BA 3400 or EC 3400 or FIN 3000

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 careers within forestry, conservation, ecology, and wildlife that represent specialties within natural resources.  
Credits: 1.0  
Lec-Rec-Lab: (1-0-0)  
Semesters Offered: Spring

FW 2000 - Environmental Science  
This is an interdisciplinary course that emphasizes the impact of humans on the environment. The course applies biological, chemical, and physical principles to the study of the environment, environmental problems and their potential solutions.  
Credits: 3.0  
Lec-Rec-Lab: (3-0-0)  
Semesters Offered: Spring

FW 2010 - Vegetation of North America  
Identification of trees and shrubs. Study of seed dispersal, dormancy, and community ecology, with an emphasis on trees. Systematic study of the major forested vegetation types of North America.  
Credits: 4.0  
Lec-Rec-Lab: (2-0-4)  
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, Wildlife Ecology & Mgmt, App Ecol & Environ Sci  
Pre-Requisite(s): FW 2010 and FW 2051

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: 2.0  
Lec-Rec-Lab: (1-0-2)  
Semesters Offered: Fall  
Restrictions: Must be enrolled in one of the following Major(s): Forestry, Wildlife Ecology & Mgmt, App Ecol & Environ Sci  
Pre-Requisite(s): FW 2010 and FW 2051

FW 3020 - Forest Ecology  
Environmental factors and plant and animal characteristics which control composition, structure, and function of forest ecosystems. Emphasis on how ecosystems change across space and time and knowledge needed to sustainably manage forest ecosystems for social, economic, and ecological benefits.  
Credits: 3.0  
Lec-Rec-Lab: (2-0-3)  
Semesters Offered: Fall

FW 3075 - Introduction to Biotechnology  
The course covers basic concepts and practical applications in biotechnology. Topics include the use of biotechnology in agriculture, healthcare, and environmental remediation. Advances in gene containment, regulatory, societal and environmental issues associated with commercialization of biotechnological products 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

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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, Summer

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 2051

FW 3170 - Land Measurements and GPS
Introduces field measurements and computations involved in determining direction, distance, and area. Covers the hand compass, pacing, and use of GPS, including differential correction. Integration of GPS data with GIS is emphasized.
Credits: 1.0
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Fall

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
Co-Requisite(s): FW 3190
Pre-Requisite(s): FW 3540

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
Pre-Requisite(s): FW 2051 and FW 3020 and FW 3200 and (MA 2710 or MA 2720 or MA 3710)

FW 3200 - Biometrics 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 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 3313 - Sustainability Science, Policy, and Assessment
Foundational scientific concepts (dynamic systems and catastrophe theory) as applied to socioecological systems. Use of indicators and indices to track progress towards sustainability goals. Review of local, national, and global sustainability policies to avoid catastrophes and guide sustainable development.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: On Demand - Offered alternate years beginning with the 2012-2013 academic year
Pre-Requisite(s): UN 2002

FW 3320 - Fundamentals of Forest Genetics and Genomics
This course will teach fundamental and applied genetic principles that are essential for management of forest and other ecosystems to maintain their long-term health and sustainability. The class will cover the following topics: structure and function of DNA, inheritance, molecular evolution, population and quantitative genetics, gene conservation, genomics and biotechnology.
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

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 1112(C) or (CH 1150(C) and CH 1151(C))

FW 3376 - Forest & Environmental Resource Management (The FERM) I
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: 2.0; May be repeated
Lec-Rec-Lab: (0-2-0)
Semesters Offered: Fall, Spring, Summer
Pre-Requisite(s): FW 2010 and FW 2051

FW 3377 - Forest & Environmental Resource Management (The FERM) II
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: 3.0; May be repeated
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring, Summer
Pre-Requisite(s): FW 2010 and FW 2051
FW 3378 - Forest & Environmental Resource Management (The FERM) III
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: 4.0; May be repeated
Lec-Rec-Lab: (0-4-0)
Semesters Offered: Fall, Spring, Summer
Pre-Requisite(s): FW 3620

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: Summer

FW 3500 - Forest Recreation
The course will review construction, use, maintenance, and management of forest recreation facilities that support non-motorized, and/or motorized uses. Field trips will include visits to a number of high-quality recreation locations to evaluate layout, design, and forest management. Assessment of forest recreation opportunities and potential conflicts will be covered.
Credits: 3.0
Lec-Rec-Lab: (2-0-3)
Semesters Offered: Summer
Pre-Requisite(s): FW 3330 and FW 3540

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 ARCGIS software package.
Credits: 4.0
Lec-Rec-Lab: (3-0-3)
Semesters Offered: Spring
Pre-Requisite(s): MA 2710(C) or MA 2720(C) or MA 3710(C) or ENVE 3502(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, Wildlife Ecology & Mgmt, App Ecol & Environ Sci; 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 or BL 1020

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 3621 - Field Ornithology Techniques
We explore the biology, behavior, and field ecology of birds. Students will learn to identify the common birds of the Upper Peninsula by sight and sound. The course involves a trip to Seney National Wildlife Refuge and Whitefish Point Bird Observatory.
Credits: 3.0
Lec-Rec-Lab: (2-0-1)
Semesters Offered: Summer

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

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

FW 4000 - Professional Experience Program
Students create oral/written report based on paid or volunteered work or field experience in natural resources.
Credits: 1.0; Repeatable to a Max of 4
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of department required

FW 4080 - Forest Economics and Finance
Financial analysis and economic theory applied to forestry project analysis and selection, focusing on prices. Covers risk, capital markets, taxation, auctions, and non-market valuation.
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 4099 - Programming Skills for Bioinformatics
Students will learn computer programming skills in Perl for processing genomic sequences and gene expression data and become familiar with various bioinformatics resources. The students will use real sequence and expression data and develop computer programs to solve real problems.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall - Offered alternate years beginning with the 2011-2012 academic year
**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**

A study of tree structure, growth, development and function, and how these are related to the environment. We will focus on the cycling of water, carbon, and nutrients within the context of global change.

**Credits:** 3.0  
**Semesters Offered:** Spring

**FW 4128 - Conservation Genetics**

This course explores how genetic variation and its loss affect the ability of natural populations to adapt to changing environments. The relevance for the long-term conservation of animal and plant populations is highlighted.

**Credits:** 3.0  
**Lec-Rec-Lab:** (3-0-0)  
**Semesters Offered:** Spring

**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:** (1-0-2)  
**Semesters Offered:** Spring  
**Restrictions:** May not be enrolled in one of the following Class(es): Freshman  
**Pre-Requisite(s):** FW 3010 or FW 3012 and FW 3540(C)

**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 4170 - Consulting Forestry**

For students who are considering consulting forestry as a career. Covers issues specific to working with private landowners, stewardship plan writing, choosing a business entity, marketing, taxes, income/expenses, insurance, timber sale administration, and resolving landowner disputes.

**Credits:** 2.0  
**Lec-Rec-Lab:** (2-0-0)  
**Semesters Offered:** Spring

**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

**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 1020 or BL 1040

**FW 4250 - The Wolves and Moose of Isle Royale**

Wolves and moose have been studied for 50 years on Isle Royale, a wilderness island in Lake Superior. The instructor leads this research and uses the research to explain predation, population dynamics, conservation genetics, and other ecological principles.

**Credits:** 2.0  
**Lec-Rec-Lab:** (1-1-0)  
**Semesters Offered:** Fall  
**Restrictions:** May not be enrolled in one of the following Class(es): Freshman

**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:** (0-3-0)  
**Semesters Offered:** Fall

**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 - Offered alternate years beginning with the 2013-2014 academic year  
**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**

The course will use a process-based approach to present the physical hydrology, geomorphology and water quality of forested watersheds. Course focuses on the interaction between watershed processes and forest management.

**Credits:** 3.0  
**Lec-Rec-Lab:** (3-0-0)  
**Semesters Offered:** Spring

**FW 4380 - Landscape Ecology and Planning**

Basic principles of landscape ecology, including pattern, process, and scale. Students will learn how to use quantitative tools to study landscape-scale patterns and processes, and how to apply these principles and tools to conservation, resource management, and planning issues.

**Credits:** 3.0  
**Lec-Rec-Lab:** (0-3-0)  
**Semesters Offered:** Spring - Offered alternate years beginning with the 2013-2014 academic year  
**Restrictions:** May not be enrolled in one of the following Class(es): Freshman, Sophomore

**FW 4400 - Urban Forestry**

Urban forestry is the science and art of managing natural resources in communities. It focuses on maximizing the wide range of economic, environmental, and social benefits associated with trees and urban greenspaces while minimizing maintenance costs and reducing tree-related risks.

**Credits:** 3.0  
**Lec-Rec-Lab:** (3-0-0)  
**Semesters Offered:** Spring
FW 4401 - Urban Forestry Lab
The urban forestry field lab is a two-day tour held in Chicago for students to interact with and learn from professionals in the green industry, arboriculture, and urban forestry. It coincides with the Midwest Urban Tree Care Forum in mid-April.
Credits: 1.0
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Spring
Pre-Requisite(s): FW 4400(C)

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 2012-2013 academic year
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore

FW 4541 - Remote Sensing of the Environment Lab
Offers students hands-on experience applying remote sensing principles and concepts to real world issues in resource management and ecosystem science. Various types of imagery and other remotely sensed data are presented along with relevant theory and analysis methods.
Credits: 1.0
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Fall - Offered alternate years beginning with the 2012-2013 academic year

FW 4545 - Map Design with GIS
Principles of making maps, from traditional to advanced visualization techniques, that convey information which is useful in decision making at many levels. Focus will be on creating maps using GIS software and digital data. A working knowledge of ArcMap is required.
Credits: 2.0
Lec-Rec-Lab: (1-0-3)
Semesters Offered: Spring - Offered alternate years beginning with the 2013-2014 academic year
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): FW 4540

FW 4550 - Forest Resources Management Lab
Covers many levels. Focus will be on creating management plans for various natural resource alternatives.
Credits: 4.0
Lec-Rec-Lab: (0-2-4)
Semesters Offered: Fall

FW 4810 - Integrated Resource Assessment
Provides a capstone experience by integrating techniques from many of the forestry, applied ecology, wildlife ecology, and management core courses. Covers multi-resource inventory of forested landscapes evaluation of forest parameters and the development of management plans for various natural resource alternatives.
Credits: 4.0
Lec-Rec-Lab: (0-4-0)
Semesters Offered: Fall, Spring
Restrictions: Permission of instructor required; Must be enrolled in one of the following Class(es): Senior
Pre-Requisite(s): FW 3190

FW 4840 - Senior Research Thesis
An independent study or research project on an approved topic in Forestry, Applied Ecology and Environmental Sciences, or Wildlife Ecology and Management, developed under the guidance of a faculty member. Available only to students in their graduating year.
Credits: 4.0
Lec-Rec-Lab: (0-4-0)
Semesters Offered: Fall, Spring
Restrictions: Permission of instructor required; Must be enrolled in one of the following Class(es): Senior
Pre-Requisite(s): FW 3190

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

FW 4900 - Applied Experiment Design and Data Analysis
This course is offered to enhance the student's knowledge in designing experiments, and the skills in analyzing and interpretation of experimental data resulting from field trials of forestry. The course will use programming language R, an open source tool that can be installed and run in any platforms.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2013-2014 academic year
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior
Pre-Requisite(s): MA 2720(C) or MA 2710(C)

Geol. & 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): Geological Engineering, Sciences & Arts Undeclared, Engineering Undeclared, General Sciences and Arts, Applied Geophysics, Geology; 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, Spring - 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 2200 - Earth History
Introduction to geological 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

GE 2300 - Introduction to Mineralogy
Identification, physical properties, chemistries, structures, uses, and occurrences of minerals. Laboratory includes hand specimen and x-ray diffraction identification of minerals.
Credits: 3.0
Lec-Rec-Lab: (2-0-3)
Semesters Offered: Fall
Pre-Requisite(s): (CH 1150 and CH 1151) and GE 2000

GE 2310 - Introduction to Petrology
Identification, physical properties, chemical composition, occurrence, and origin of the important types of igneous, sedimentary, and metamorphic rocks. Laboratory includes hand specimen description and identification of rocks.
Credits: 3.0
Lec-Rec-Lab: (2-0-3)
Semesters Offered: Spring
Pre-Requisite(s): GE 2300

GE 2320 - Geochemistry
Introductory course to 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 1150 and CH 1151

GE 2340 - 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

GE 2350 - Structural Geology
Introduction to structural geology emphasizing the geometry, origin, and mechanics of folds, foliations, lineations, faults and joints, and structures in orogenic belts.
Credits: 4.0
Lec-Rec-Lab: (2-0-3)
Semesters Offered: Spring
Pre-Requisite(s): GE 2000

GE 3040 - Fundamentals of Applied and Environmental Geophysics
An introduction to geophysical methods 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 3050 - Structural Geology
Rock structures and regional settings resulting from the application of deforming forces, including the geometry, origin, and mechanics of folds, foliations, lineations, faults and joints, and structures in orogenic belts.
Credits: 4.0
Lec-Rec-Lab: (3-0-2)
Semesters Offered: Spring
Pre-Requisite(s): GE 2000

GE 3100 - Computational Geosciences
Introduction to quantitative analysis and display of geologic data using R/Matlab, covering basic R/Matlab syntax and programming, and analysis of one-dimensional (e.g. time series) and two-dimensional datasets (i.e. spatial data). Techniques are applied to geological datasets.
Credits: 3.0
Lec-Rec-Lab: (2-0-1)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): MA 1160 or MA 1161

GE 3200 - Analytical Methods
An introductory course to modern analytical methods. 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 1150 and CH 1151

GE 3250 - 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 3260 - 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 3300 - Earth History
This course covers the history of the Earth from 4.5 billion years to the present. Plate tectonics is the organizing theme with emphasis on recognizing and evaluating the evidence for the major reorganizations of the Earth's crust.
Credits: 3.0
Lec-Rec-Lab: (2-0-3)
Semesters Offered: Fall
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, Spring - 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: (0-0-3)
Semesters Offered: Summer

GE 3670 - Oceanographic Science
A multidisciplinary integration of the core sub-disciplines of oceanography (physics, chemistry, biology, and geology). Hands on laboratory introducing oceanographic observational techniques and analysis. Upper-level science course designed for students in a variety of majors.
Credits: 3.0
Lec-Rec-Lab: (2-0-2)
Semesters Offered: Fall
Pre-Requisite(s): PH 1200 and (GE 2000 or BL 1010 or BL 1040 or CH 1150)

GE 3710 - Geology and Ecology of Modern Reefs
Introductory lab/field course intended for students interested in learning about the geology and ecology of the modern reefs of the Kenya Coast. The course will focus on the geology of the near-shore environment.
Credits: 2.0
Lec-Rec-Lab: (1-0-3)
Semesters Offered: Spring
Restrictions: Permission of department required

GE 3720 - Soil Genesis and Crops
The quality of many high-value crops depends on climate and soil conditions. Geology, topography, and ocean proximity combine to produce distinct microclimates and soils which impact crop attributes. We will explore relationships between these factors and crops in the Cape Town region.
Credits: 2.0
Lec-Rec-Lab: (1-0-3)
Semesters Offered: Spring, 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 rock slope stability. Previous coursework in tensors not required.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Pre-Requisite(s): GE 3050

GE 3850 - Geohydrology
Geologic and hydrologic factors controlling the occurrence, movement, and development of subsurface water. Quantitative methods for analyzing groundwater systems are introduced.
Credits: 3.0
Lec-Rec-Lab: (2-0-3)
Semesters Offered: Fall

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: 3.0
Lec-Rec-Lab: (2-0-2)
Semesters Offered: Summer
Restrictions: Permission of department required
Pre-Requisite(s): GE 2000 and GE 2310 and GE 3050

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: 5.0
Lec-Rec-Lab: (0-0-9)
Semesters Offered: Summer
Restrictions: May not be enrolled in one of the following Major(s): Geological Engineering, Applied Geophysics
Pre-Requisite(s): GE 2000 and GE 2310 and GE 3050

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 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
GE 4180 - Volcanology
Volcanoes and how they work. Volcanic eruption styles and products, their recognition, and significance. Volcanic hazards, volcano monitoring and impacts of volcanism on the environment, climate and society. Applies chemistry, physics, and fluid mechanics in a volcanological context.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): GE 2000 and (MA 1160 or MA 1161)

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 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 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, Spring
Pre-Requisite(s): MA 3160 and PH 2100

GE 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 air 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): ENVE 3501 or ENVE 3503

GE 4530 - Planetary Geology & Geophysics
Geological, geophysical, and geochemical processes in the Solar System are examined. Topics include the formation and evolution of the Solar System, planetary surface processes and water distribution, impact structures, composition, structure, and dynamics of planetary interiors, geophysical exploration of planets.
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): GE 2000 and PH 2200 and MA 2160

GE 4560 - Earthquake Seismology
Physics of earthquakes and seismic energy propagation including stress and strain, elastic wave equation, body and surface waves, anelasticity, anisotropy, earthquake location, earthquake sources, passive seismic imaging. Homework will require computer skills in Matlab or similar.
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): GE 3050 and PH 2100 and MA 3160

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: Spring
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

GE 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 2001 or EC 3002 or EC 3003

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 - Offered alternate years beginning with the 2009-2010 academic year
Pre-Requisite(s): EC 2001

GE 4640 - Introduction to Atmospheric Physics
Essential elements of atmospheric physics, including thermodynamics, (adiabatic processes, phase transformations, stratification), aerosol and cloud physics (e.g. nucleation, Kohler theory, growth by condensation and collection), radiative transfer (e.g. Beer’s law, transfer equations with and without scattering).
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall - Offered alternate years beginning with the 2013-2014 academic year
Pre-Requisite(s): (PH 2200 or PH 2260) and (PH 1360 or PH 2300) and MA 3160 and (MA 3520 or MA 3521 or MA 3530 or MA 3560)
GE 4670 - Aquatic Remote Sensing
Overview of remote sensing techniques used to observe aquatic systems. Integrative approach to physical and biogeochemical remotely sensed properties emphasized from the perspective of oceanographic phenomena observed with examples/applications to take. Imagery processing/interpretation utilizing space agency processing software and MATLAB.
Credits: 3.0
Lec-Rec-Lab: (2-0-2)
Semesters Offered: Spring
Pre-Requisite(s): PH 1200 and (CH 1150 or GE 2000 or BL 1010 or BL 1040)

GE 4700 - Geologic Mapping of Remote Terrain
Introduces students to the art and science of producing a geologic map for virtually any area of the world using satellite data and modern software and tools.
Credits: 3.0
Lec-Rec-Lab: (0-2-1)
Semesters Offered: Spring

GE 4760 - Geology and Exploration for Mineral Deposits
Geology, geologic evaluation, and exploration for mineral resources with emphasis on metals. Course covers geologic characteristics of a variety of classes of mineral deposits, design of exploration programs, design of drilling programs, concepts of resource estimation, and reporting requirements. Laboratory includes study of specimens from specific localities and simulated subsurface exploration.
Credits: 3.0
Lec-Rec-Lab: (2-0-3)
Semesters Offered: Fall
Pre-Requisite(s): GE 2310 and GE 3050 and GE 3910

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 4860 - Computer Methods in Geomechanics
Computer methods for the design problems encountered in geomechanics. Applications to be selected from slope stability, earth retention systems, and seepage. Students will be introduced to limit equilibrium and finite element analysis through theory and computational labs.
Credits: 3.0
Lec-Rec-Lab: (2-0-3)
Semesters Offered: Spring
Pre-Requisite(s): (GE 2000 or GE 2100) and (MEEM 2150 or ENG 2120) and (ENG 3200 or ENG 3907)

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: On Demand

GE 4916 - Field Geology in East and South Africa
Introduction to problems and methods of field geology. Data gathering and interpretation of field relationships using Brunton, GPS LandSat, etc. in East Africa. Requires geological report and digital maps.
Credits: 6.0
Lec-Rec-Lab: (0-0-18)
Semesters Offered: Spring, Summer
Restrictions: Permission of instructor required
Pre-Requisite(s): GE 3050

GE 4917 - Geology of East Africa
Introduction to geology of East Africa. Intended for students with an interest in geological sciences. Requires paper(s) and digital scrapbook.
Credits: 4.0
Lec-Rec-Lab: (0-0-12)
Semesters Offered: Summer
Restrictions: Permission of instructor required

GE 4930 - Special Topics in Geological Engineering
Study and discussion of geological engineering topics.
Credits: variable to 5.0; Repeatable to a Max of 10
Semesters Offered: On Demand
Restrictions: Permission of instructor required

GE 4931 - Special Topics in Geology
Study and discussion of geology topics.
Credits: variable to 5.0; Repeatable to a Max of 10
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 5.0; Repeatable to a Max of 10
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 5.0; Repeatable to a Max of 10
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 5.0; Repeatable to a Max of 10
Semesters Offered: On Demand
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 4970 - Special Topics in Global Environment Change
Course will focus on emerging topics on global environment change including changes in atmospheric composition and air quality, air pollution meteorology, extreme meteorological events, and ocean chemistry. Anthropogenic contributions to these changes will be presented and analyzed. Students will work on projects based on historical records from multiple datasets to evaluate and appreciate the long-term changes in the global environment and better understand the perturbations due to human activities.
Credits: 3.0; Repeatable to a Max of 6
Lec-Rec-Lab: (2-1-0)
Semesters Offered: Fall, Spring

Humanities

HU 0110 - Undergraduate Student Coaching
Schedule weekly appointments with a writing coach to strengthen writing and reading effectiveness in any course except Composition. Specialized assistance available to students who speak English as a Second Language, students who have learning disabilities and students who are undergraduate writing coaches. Credits do not count toward graduation.
Credits: 0.0; May be repeated
Semesters Offered: Fall, Spring, Summer

HU 0122 - Global Issues Study Team
Students who are enrolled in Global Issues (UN1025) may sign up for a study team led by a writing center coach. Teams meet twice weekly. The meetings address the challenges of the Global Issues 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: Fall, Spring, Summer
Co-Requisite(s): UN 1025

HU 0123 - Composition Coaching
Scheduled weekly appointment with a writing coach to improve writing and reading effectiveness in Composition (UN1015). 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, Summer
Co-Requisite(s): UN 1015

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, Summer
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 - The Writer's Craft
An introduction to reading and writing in contemporary and emerging creative writing, including, but not limited to, fiction, nonfiction, poetry, and screenplay. Stresses individual production through process-oriented writing exercises, small group workshops, individual conferences, and creative theory.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Summer

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, Summer

HU 2201 - Level I-A Chinese Language and Culture
Introduction to basic Chinese grammar, vocabulary, and idiomatic expressions, designed to help students acquire the basics of oral and written Chinese. Includes study of contemporary Chinese culture.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Summer

HU 2202 - Level I-B Chinese Language and Culture
Further study of Chinese grammar, vocabulary, and idioms with emphasis on conversation and communicative strategies. Includes continued study of Chinese culture.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): HU 2201 or Language Placement Chinese >= 100

HU 2241 - Level I-A Less Commonly Taught Languages
Introduction to basic grammar, vocabulary, and idioms, designed to help students acquire the basics of oral and written communication. Includes study of cultures in which the language is spoken.
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): Senior

HU 2242 - Level I-B Less Commonly Taught Languages
Further study of grammar, vocabulary, and idioms with emphasis on conversation and communicative strategies. Includes continued study of cultures in which the language is spoken.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Pre-Requisite(s): HU 2241
HU 2271 - Level I-A French Language and Culture
Introduction to basic French grammar, vocabulary, and idioms designed to help students acquire the basics of oral and written French. Includes study 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, and idioms with continued practice of conversation and basic readings in French. Continued study of contemporary French speaking cultures.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring, Summer
Pre-Requisite(s): HU 2271 or Language Placement French >= 131

HU 2273 - Transitional Level I French Language and Culture
Intensive study of basic 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 placement credits.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring, Summer
Pre-Requisite(s): HU 2271 or Language Placement French >= 211

HU 2281 - Level I-A German Language and Culture
Introduction to the basics of the German language, acquainting students with the essentials of oral and written German and introducing cultures and societies of contemporary German-speaking Europe.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Pre-Requisite(s): Language Placement French >= 211

HU 2282 - Level I-B German Language and Culture
Further study of the basics of the German language acquainting students with the essentials of oral and written German, with emphasis on conversational skills. Includes continued discussion of cultures and societies of contemporary German-speaking Europe.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring, Summer
Pre-Requisite(s): HU 2281 or Language Placement German >= 201

HU 2291 - Level I-A Spanish Language and Culture
Introduction to basic Spanish grammar, vocabulary, and idioms, designed to help students acquire the basics of oral and written Spanish. Includes study of contemporary Spanish-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 2292 - Level I-B Spanish Language and Culture
Further study of basic Spanish grammar, vocabulary, and idioms with continued practice of conversation and basic readings in Spanish. Continued study of selected Hispanic cultures.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring, Summer
Pre-Requisite(s): HU 2291 or Language Placement Spanish >= 131

HU 2293 - Transitional Level I Spanish Language and Culture
Intensive review of basic 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 placement credit.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring
Pre-Requisite(s): HU 2291 or Language Placement Spanish >= 201

HU 2324 - Introduction to Film
Focuses on film narration and style within social, cultural, and historical contexts. Emphasizes critical engagement with film through discussion, presentations, and written analysis. May include small video production projects and opportunities to interact with filmmakers and industry professionals.
Credits: 3.0
Lec-Rec-Lab: (0-2-3)
Semesters Offered: Fall, Spring, Summer

HU 2400 - Introduction to Diversity Studies in the United States
This course provides students with a better understanding of underrepresented populations within the United States by examining the social, cultural, and personal consequences of gender, race, ethnicity, class, sexual orientation, (dis)ability, and other significant identities.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall

HU 2501 - American Experience in Literature
A survey of major works in American Literature from origins to the present. Focuses on historical trends in the development of literature and culture in the Americas with particular emphasis on the United States.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring

HU 2505 - Science, Technology, and Humanities
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 modern era.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand - Offered alternate years beginning with the 2000-2001 academic year

HU 2520 - Cultural Diversity in American Literature
Study of literature by authors from historically under-represented groups within the United States. May be supplemented by literature from across the Americas, films, and essays on theories and approaches to difference in the American context.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring

HU 2538 - British Experience in Literature
A survey of selected works of British literature from its origins to the present. Focuses on historical trends in the development of the English language and the cultures of Great Britain.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring - Offered alternate years beginning with the 2002-2003 academic year

HU 2540 - The Spoken Word
Study of spoken and/or performed literatures, staged and paged, including, but not limited to oral tradition, poetry, spoken word, hip-hop, rap, screenplay, and drama.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2011-2012 academic year
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Description</th>
<th>Credits</th>
<th>Lec-Rec-Lab</th>
<th>Semesters Offered</th>
</tr>
</thead>
<tbody>
<tr>
<td>HU 2548</td>
<td>Young Adult Literature</td>
<td>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.</td>
<td>3.0</td>
<td>(0-3-3)</td>
<td>Fall, Summer</td>
</tr>
<tr>
<td>HU 2600</td>
<td>Introduction to the Field of Scientific and Technical Communication</td>
<td>An introduction to the history, theory, and practice of scientific and technical communication as preparation for future study.</td>
<td>3.0</td>
<td>(0-3-0)</td>
<td>Fall, Summer</td>
</tr>
<tr>
<td>HU 2631</td>
<td>Fundamentals of Darkroom Photography</td>
<td>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.</td>
<td>3.0</td>
<td>(0-2-3)</td>
<td>On Demand</td>
</tr>
<tr>
<td>HU 2632</td>
<td>Fundamentals of Digital Photography</td>
<td>Explores the history, aesthetics, theory, and practice of photography in the digital environment. Students learn in-depth digital camera and imaging production techniques. Students provide their own digital camera, preferably a digital SLR.</td>
<td>3.0</td>
<td>(0-2-3)</td>
<td>Summer</td>
</tr>
<tr>
<td>HU 2633</td>
<td>Fundamentals of Digital Imaging</td>
<td>Explores the history, aesthetic, theory, and practice of digital imaging. Students learn production and post-production techniques. Students may provide their own digital SLR camera.</td>
<td>3.0</td>
<td>(0-2-3)</td>
<td>Fall, Spring, Summer</td>
</tr>
<tr>
<td>HU 2642</td>
<td>Introduction to Digital Media</td>
<td>Basic principles, practices and implications of digital media communication and production. Provides foundation in tools, techniques and processes through hands-on production, readings, discussion and analysis of contemporary issues related to digital media.</td>
<td>3.0</td>
<td>(0-3-0)</td>
<td>Fall, Spring, Summer</td>
</tr>
<tr>
<td>HU 2645</td>
<td>Graphic and Information Design</td>
<td>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.</td>
<td>3.0</td>
<td>(0-3-0)</td>
<td>Fall, Spring</td>
</tr>
<tr>
<td>HU 2700</td>
<td>Introduction to Philosophy</td>
<td>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.</td>
<td>3.0</td>
<td>(0-3-0)</td>
<td>Fall, Spring</td>
</tr>
<tr>
<td>HU 2760</td>
<td>Logic and Critical Thinking</td>
<td>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.</td>
<td>3.0</td>
<td>(0-3-0)</td>
<td>Fall</td>
</tr>
<tr>
<td>HU 2762</td>
<td>Ethical Theory and Moral Problems</td>
<td>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.</td>
<td>3.0</td>
<td>(0-3-0)</td>
<td>Fall</td>
</tr>
<tr>
<td>HU 2780</td>
<td>Research and Writing in Communication</td>
<td>Prepare students to evaluate, design, and conduct research in communication. Develops research-related writing strategies and proficiency.</td>
<td>3.0</td>
<td>(0-3-0)</td>
<td>Fall</td>
</tr>
<tr>
<td>HU 2782</td>
<td>Communication and Culture</td>
<td>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</td>
<td>3.0</td>
<td>(0-3-0)</td>
<td>Fall, Summer</td>
</tr>
<tr>
<td>HU 2783</td>
<td>Introduction to Speech Communication</td>
<td>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.</td>
<td>3.0</td>
<td>(0-3-0)</td>
<td>Fall, Spring, Summer</td>
</tr>
<tr>
<td>HU 2910</td>
<td>Language and Mind</td>
<td>Linguistic study of structural and cognitive aspects of language. Examines language design: how sounds, words, sentences, and conversation create meaning; the relationship of language, brain, mind, and thought; the ability of humans, animals, and machines to acquire language.</td>
<td>3.0</td>
<td>(0-3-0)</td>
<td>Fall, Summer</td>
</tr>
</tbody>
</table>

Undergraduate Course Descriptions Effective Fall 2013, Page 72 of 126
HU 2920 - Language and Society
Examines how societies use and organize themselves with respect to language. Considers attitudes towards language standardization and dialectal variations within the US based on geography, class, ethnicity, gender, age, etc., and speakers' choices of how they present themselves linguistically.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring

HU 3110 - The Writer's Workshop
Workshop practice in creative writing. May include fiction, nonfiction, poetry, screenplay, or hybrid forms. Stresses individual production through process-oriented writing exercises, small group workshops, individual conferences and creative theory with the goal of creating manuscripts of publishable quality.
Credits: 3.0; Repeatable to a Max of 6
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2011-2012 academic year
Pre-Requisite(s): HU 2110(C)

HU 3120 - Technical and Professional 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, Summer
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): UN 1015 or UN 2001

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 1015 or UN 2001

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 is used; the authority of written texts; access to reading and writing to and various textual media.
Credits: 3.0
Research
Semesters Offered: Fall, Spring
Pre-Requisite(s): UN 1015 or 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 1015 or UN 2001

HU 3201 - Level II-A Chinese Language and Culture
Review and continued study of listening, speaking, reading, and writing in Chinese. Students learn how to communicate in Chinese societies. Includes study of various aspects of the Chinese culture.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): HU 2202 or Language Placement Chinese >= 201

HU 3202 - Level II-B Chinese Language and Culture
Further study of Chinese language. Includes study of vocabulary, idioms, and sentences structure to improve conversational, reading, and writing abilities. Includes discussion of various aspects of Chinese culture.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): HU 3201 or Language Placement Chinese >= 301

HU 3204 - Level III Topics in Chinese Literature and Culture
Study of various genres of Chinese literature and of various aspects of Chinese society, emphasizing historical and cultural backgrounds. Conducted primarily in Chinese.
Credits: 3.0; Repeatable to a Max of 6
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): HU 3202 or Language Placement Chinese >= 401

HU 3211 - The Writer's Workshop
Workshop practice in creative writing. May include fiction, nonfiction, poetry, screenplay, or hybrid forms. Stresses individual production through process-oriented writing exercises, small group workshops, individual conferences and creative theory with the goal of creating manuscripts of publishable quality.
Credits: 3.0; Repeatable to a Max of 6
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2011-2012 academic year
Pre-Requisite(s): HU 2110(C)

HU 3212 - Chinese Language and Culture
Further study of Chinese language. Includes study of vocabulary, idioms, and sentence structure to improve conversational, reading, and writing abilities. Includes discussion of various aspects of Chinese culture.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): HU 3201 or Language Placement Chinese >= 301

HU 3241 - Level II A Less Commonly Taught Language and Culture
Review and continued study of listening, speaking, reading, and writing in less commonly taught language. Students learn how to communicate in target culture. Includes study of various aspects of the culture in which the language is used.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): HU 2242

HU 3242 - Level II B Less Commonly Taught Language and Culture
Further study of less commonly taught language. Includes study of vocabulary, idioms, and sentence structure to improve conversational reading and writing abilities and discussions of various aspects of culture in which the language is used.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): HU 3241

HU 3253 - World Literatures & Cultures
Comparative approach to world literatures and cultures. May include literary works, critical essays, films, music, and other representations of world culture.
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

HU 3261 - Topics in Communicating Across Cultures
Examines communication practices and styles across selected cultures and multicultural groups, drawing on an interdisciplinary range of research fields. May address social issues, language and cultural differences, gender, race, ethnicity, class, disabilities, age, religion, family and national identity.
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 1025 or 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 Francophone societies. Includes study of film and other media and a critical examination of cross-cultural differences between French, Francophone, and U.S. 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): Freshman

Undergraduate Course Descriptions Effective Fall 2013, Page 73 of 126
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: Spring
Restrictions: May not be enrolled in one of the following Class(es):
Freshman

HU 3264 - Topics in Spanish-Speaking Cultures
An introduction to Spanish-speaking cultures (in English) in comparative historical perspectives. Includes a survey and a critical cross-cultural examination of Latin-American cultures and Spanish-speaking societies (European, Caribbean, and North, Central and South American) through literature, music, film, art, and other media.
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

HU 3265 - Topics in East Asian Cultures
Introduction to the contemporary and traditional cultures of China, Korea, and Japan taught through readings, films, lectures, and discussions. Taught in English.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring

HU 3271 - Level II-A French Language and Culture
Review and continued study of grammar, vocabulary, speaking, listening, reading, and writing in French. Includes written compositions and oral presentations. Cultural focus on several Francophone regions of the world.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): HU 2272 or HU 2273 or Language Placement French >= 331

HU 3272 - Level II-B French Language and Culture
Continued study of grammar, vocabulary, speaking, listening, reading, and writing in French. Includes written compositions, oral presentations, and reading of brief literary texts. Cultural focus on several Francophone regions of the world.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring
Pre-Requisite(s): HU 3271 or Language Placement French >= 421

HU 3273 - Level II French Composition and Conversation
Extensive work in the active, creative use of written and oral French. Includes development of communicative strategies, written compositions, and oral presentations in the context of contemporary French-speaking cultures. May include study of film and other media.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring
Pre-Requisite(s): HU 2272 or HU 2273 or Lang Placement French I-A Tran >= 301

HU 3274 - Level III Topics in French Literature and Culture
Topics in French literature and its historical and cultural contexts. May include selections from Francophone literature. Conducted in French.
Credits: 3.0; Repeatable to a Max of 6
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall - Offered alternate years beginning with the 2013-2014 academic year
Pre-Requisite(s): HU 3272 or HU 3273 or Language Placement French >= 501

HU 3275 - Level III French for Special Purposes
Study of business, technical, and/or scientific discourses in the context of French language and Francophone 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 2013-2014 academic year
Pre-Requisite(s): HU 3272 or HU 3273 or Language Placement French >= 501

HU 3280 - Level I-C German Language and Culture
Concluding study of the basics of the German language acquainting students with the essentials of oral and written German, with emphasis on conversational skills. Includes continued discussion of cultures and societies of contemporary German-speaking Europe.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring
Pre-Requisite(s): HU 2282 or Language Placement German II-A >= 221

HU 3281 - Level I-A German Language and Culture
Review of the basics of the German language. Includes study of vocabulary, idioms, and sentence structure 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, Spring
Pre-Requisite(s): HU 2282 or Language Placement German >= 321

HU 3282 - Level II-B German Language and Culture
Review of the basics of the German language. Includes study of vocabulary, idioms, and sentence structure to improve conversational and reading abilities, discussion of various aspects of contemporary German culture, readings of literary texts, screenings of German films, and writing of compositions in German.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring
Pre-Requisite(s): HU 3281 or Language Placement German >= 321

HU 3283 - Level II German for Special Purposes
Review of the basics of the German language. Extensive work on the creative use of written and oral German with emphasis on short themes in German.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring
Pre-Requisite(s): HU 3282 or Language Placement German >= 421

HU 3284 - Level III German Literature and Culture
Study of German literature and cultures. Topics may include postwar German literature, Germany since WW II, or emphasis on a major contemporary writer. Readings, discussion and writing in German.
Credits: 3.0; Repeatable to a Max of 6
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): HU 3281 and (HU 3282 or HU 3283) or Language Placement German >= 521

HU 3285 - Level III German: Film and Media
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: Spring
Pre-Requisite(s): HU 3281 and (HU 3282 or HU 3283) or Language Placement German >= 521
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>HU 3291</td>
<td>Level II Spanish Language and Culture</td>
<td>Review and continued study of grammar, vocabulary, speaking, listening, reading, and writing in Spanish. Includes written compositions and oral presentations. Cultural focus on several Spanish-speaking regions. Students completing this course may apply for placement credit. Credits: 3.0</td>
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<td>Lec-Rec-Lab:</td>
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<td>Semesters Offered:</td>
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<tr>
<td>Pre-Requisite(s):</td>
<td>HU 2292 or HU 2293 or Language Placement Spanish &gt;= 321</td>
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<tr>
<td>HU 3292</td>
<td>Level II-B Spanish Language and Culture</td>
<td>Continued study of grammar, vocabulary, speaking, listening, reading, and writing in Spanish. Includes written compositions, oral presentations, and readings of short literary and documentary texts. Strong cultural focus on several Spanish-speaking regions. Students completing this course may apply for placement credit. Credits: 3.0</td>
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<td>Lec-Rec-Lab:</td>
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<td>Semesters Offered:</td>
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<tr>
<td>Pre-Requisite(s):</td>
<td>HU 2292 or HU 3291 or Language Placement Spanish &gt;= 401</td>
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<tr>
<td>HU 3293</td>
<td>Level IIC Spanish Composition and Conversation</td>
<td>Advanced grammar, composition, and conversation practice. Readings may include texts from literary, social, economic, scientific, engineering, or business discourses in the context of Hispanic cultures. Students completing this course may apply for placement credit. Credits: 3.0</td>
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<td>Semesters Offered:</td>
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<td>Pre-Requisite(s):</td>
<td>HU 2293 or HU 3291 or HU 3292 or Language Placement Spanish &gt;= 480</td>
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<tr>
<td>HU 3294</td>
<td>Hispanic Literatures and Cultures</td>
<td>Study of selected works of literature, culture, and civilization from selected regions of the Spanish-speaking world. May incorporate study of literary genres and historical periods as related to Spain and/or Latin American cultures. Students completing this course may apply for placement credits. Credits: 3.0; Repeatable to a Max of 9</td>
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<td>Lec-Rec-Lab:</td>
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<td>Semesters Offered:</td>
<td>Fall</td>
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<tr>
<td>Pre-Requisite(s):</td>
<td>HU 3293 or Language Placement Spanish &gt;= 631</td>
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<tr>
<td>HU 3295</td>
<td>Level III Advanced Spanish for Specific Literacies</td>
<td>Study of specific area discourses in Spanish. May include readings and discussion topics in intercultural communication, philosophy, literature, film, environmental studies, and/or social studies. Emphasis on the understanding of key issues across disciplines, histories, and cultures. Stresses reading, writing, and oral presentation. Students completing this course may apply for placement credit. Credits: 3.0; Repeatable to a Max of 9</td>
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<td>Lec-Rec-Lab:</td>
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<td>Semesters Offered:</td>
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<tr>
<td>HU 3325</td>
<td>Film History and Theory</td>
<td>Survey of film history and theory and their technological and sociocultural contexts. Focus on key concepts and movements such as narrative, auteurism, realism, and genre. Credits: 3.0</td>
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<td>Lec-Rec-Lab:</td>
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<td>Semesters Offered:</td>
<td>Spring</td>
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<tr>
<td>Pre-Requisite(s):</td>
<td>HU 2324</td>
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<tr>
<td>HU 3326</td>
<td>Topics in World Cinema</td>
<td>This course focuses on mainstream and/or independent films in their historical and sociocultural contexts from selected regions such as Latin America, Africa, the Middle East, Asia, and Europe. Credits: 3.0; Repeatable to a Max of 6</td>
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<td>Lec-Rec-Lab:</td>
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<td>Semesters Offered:</td>
<td>Spring</td>
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<td>Pre-Requisite(s):</td>
<td>HU 2324</td>
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<tr>
<td>HU 3327</td>
<td>Topics in Film History</td>
<td>Survey of film history and theory and their technological and sociocultural contexts. Focus on key concepts and movements such as narrative, auteurism, realism, and genre. Credits: 3.0</td>
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<td>Lec-Rec-Lab:</td>
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<td>Semesters Offered:</td>
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<tr>
<td>Pre-Requisite(s):</td>
<td>HU 2324</td>
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<tr>
<td>HU 3400</td>
<td>Topics in Diversity Studies</td>
<td>This course provides students with a better understanding of underrepresented populations within the United States by examining the culture and experience of African American; American Indian; Asian American; Latina/Latino American; Gay, Lesbian, Bisexual, and Transsexual; or Post-Colonial peoples. Credits: 3.0; Repeatable to a Max of 9</td>
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<td>Lec-Rec-Lab:</td>
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<td>Semesters Offered:</td>
<td>Spring</td>
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<tr>
<td>HU 3401</td>
<td>Gender and Culture</td>
<td>Interrelations of gender and culture, including comparative analysis of constructions of gender. May examine different societies and/or different historical periods. Credits: 3.0; Repeatable to a Max of 6</td>
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<tr>
<td>Lec-Rec-Lab:</td>
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<td>Semesters Offered:</td>
<td>On Demand</td>
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<tr>
<td>HU 3501</td>
<td>Medieval Literature &amp; Cultures</td>
<td>Study of literary texts and other representations of medieval culture from the European Middle Ages including English and other cultural traditions in translation. Credits: 3.0</td>
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<td>Lec-Rec-Lab:</td>
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<td>Semesters Offered:</td>
<td>Fall - Offered alternate years beginning with the 2000-2001 academic year</td>
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<tr>
<td>HU 3502</td>
<td>World Mythologies</td>
<td>Survey of the major mythological systems of the world with particular attention to those areas of commonality among various civilizations. Films may provide contextual background. Credits: 3.0</td>
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<td>Lec-Rec-Lab:</td>
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<td>Semesters Offered:</td>
<td>Spring, Summer - Offered alternate years beginning with the 2001-2002 academic year</td>
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<tr>
<td>HU 3504</td>
<td>Studies in the Novel</td>
<td>Examination of the novel in world literature with special attention to the historical, cultural, and personal contexts within which the author is writing. Film versions may be examined. Credits: 3.0</td>
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<tr>
<td>Lec-Rec-Lab:</td>
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<td>Semesters Offered:</td>
<td>On Demand</td>
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<tr>
<td>HU 3510</td>
<td>The American Novel</td>
<td>Examination of the novel in American literature with special attention to the historical, cultural, and personal contexts within which the author is writing. Film versions may be examined. Credits: 3.0</td>
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<td>Lec-Rec-Lab:</td>
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<td>Semesters Offered:</td>
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<tr>
<td>HU 3513</td>
<td>Shakespeare</td>
<td>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</td>
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<td>Semesters Offered:</td>
<td>Fall, Spring, Summer</td>
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<tr>
<td>HU 3517</td>
<td>Literary Theory and Criticism</td>
<td>A consideration of a variety of theoretical and critical approaches and methods of literary research in the study of British and American literature. Credits: 3.0</td>
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<td>Lec-Rec-Lab:</td>
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<tr>
<td>Semesters Offered:</td>
<td>Spring - Offered alternate years beginning with the 2004-2005 academic year</td>
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</tbody>
</table>
### HU 3540 - Major British Authors
In-depth reading of the works of one or more British authors (excluding Shakespeare), including surrounding criticism. Film versions may be examined.

**Credits:** 3.0; Repeatable to a Max of 6  
**Lec-Rec-Lab:** (0-3-0)  
**Semesters Offered:** Fall

### HU 3541 - Major American Authors
In-depth reading of the works of one or more American authors, including surrounding criticism. Film versions may be examined.

**Credits:** 3.0; Repeatable to a Max of 6  
**Lec-Rec-Lab:** (0-3-0)  
**Semesters Offered:** Spring

### 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, Summer - Offered alternate years beginning with the 2004-2005 academic year

### HU 3554 - Science Fiction and Fantasy Literature
Close study of significant works in science fiction and fantasy. Examines genre features and usage and attends to a writer's style and methods. Regularly focuses on historical fiction and fantasy using film to help establish literary context.

**Credits:** 3.0; Repeatable to a Max of 6  
**Lec-Rec-Lab:** (0-3-0)  
**Semesters Offered:** On Demand

### HU 3555 - Modern and Contemporary British Literature
Study of British, British colonial and post-colonial literatures of the twentieth and twenty-first centuries. Explores relationships between literature and other areas of the arts and culture. May include attention to emerging and non-traditional writers and genres.

**Credits:** 3.0  
**Lec-Rec-Lab:** (0-3-0)  
**Semesters Offered:** Fall - Offered alternate years beginning with the 2001-2002 academic year

### HU 3556 - Modern and Contemporary American Literature
Study of American literatures of the twentieth and twenty-first centuries. Explores relationships between literature and other areas such as the arts, film architecture, history and philosophy. May include attention to emerging and non-traditional writers and genres.

**Credits:** 3.0  
**Lec-Rec-Lab:** (0-3-0)  
**Semesters Offered:** Fall - Offered alternate years beginning with the 2011-2012 academic year

### HU 3600 - Professional Development in the Humanities
Addresses conventions and expectations for professional development through projects such as portfolio development and research into contemporary professional and work place issues. Explores career and graduate school opportunities.

**Credits:** 3.0  
**Lec-Rec-Lab:** (0-3-0)  
**Semesters Offered:** On Demand

### 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

### 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:** Fall, Spring

### 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, Summer  
**Pre-Requisite(s):** UN 1015 or UN 2001

### 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 2642 and HU 2633 or HU 2645

### HU 3650 - Introduction to Web Design
Provides experience in planning and constructing web pages. Discusses historical, ethical, and social implications, as well as problems and limitations, of the Internet and the World Wide Web. Students develop a balance of technical, aesthetic, and theoretical knowledge.

**Credits:** 3.0  
**Lec-Rec-Lab:** (0-2-3)  
**Semesters Offered:** Spring  
**Pre-Requisite(s):** HU 2642 and (HU 2645 or HU 2633)

### 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

### HU 3701 - Philosophy of Technology
A study of philosophical analyses of technology. Topics may include: the essence and nature of technology, technology and human existence; the notion that we live in a technological age; and ethical issues surrounding the use, abuse, and ubiquity of technology.

**Credits:** 3.0  
**Lec-Rec-Lab:** (0-3-0)  
**Semesters Offered:** Fall
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

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

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

HU 3800 - Communication Theory
Surveys communication theories in the twentieth century to the present. Examples may include: propaganda, mass society, meaning and representation, symbolic interaction, performance, modes of communication, relational systems, and actor-network. Considers implications of these theories in contemporary contexts.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring

HU 3810 - Technology and Cultural Theory
Considers interrelationships between technology and culture. Includes understanding the context within which technologies are developed and used, and how assumptions about technology shape knowledge, practice, and creative action. Issues such as progress, determinism, ethics, gender, race, class, globalization, and "humanness".
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall

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, Summer

HU 3830 - Creativity, Culture, and Change
Examines the sources of creativity and the ways that it has been used to change cultural values, feelings, beliefs, and practices. A project-based course that cultivates and applies creative action toward cultural change.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring

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

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): HU 2820

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

HU 3871 - New Media Theory
Examines relationships among changing communication technologies and communication theories. Emphasizes issues involving emerging technologies and emerging theory.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring

HU 3882 - Media Industries
Examines economic, political, and cultural aspects of media industries (cinema, broadcasting, music, gaming, telecommunications, and advertising).
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall

HU 3890 - Documentary
Considers technical, theoretical, aesthetic and ethical dimensions of documentary media through analysis and production.
Credits: 3.0
Lec-Rec-Lab: (0-2-3)
Semesters Offered: Fall

HU 3910 - Global Language Issues
Considers the historical rise of the English language and other dominant languages, and present effects on minority and endangered languages within the US and abroad: World Englishes and dialectal variation; and the interaction of forces of globalization/standardization with localization/identity.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2009-2010 academic year

HU 3940 - Language and Identity
Examines how individuals create and perform their social identities through and in response to language, considering social variables such as race, ethnicity, class, gender, sexuality, disability, geography, power, ideology, etc. Explores how these variables may intersect, clash, and be resolved.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2010-2011 academic year
Restrictions: May not be enrolled in one of the following Class(es): Freshman
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Description</th>
<th>Credits</th>
<th>Lec-Rec-Lab:</th>
<th>Semesters Offered</th>
<th>Restrictions</th>
<th>Pre-Requisite(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HU 3961</td>
<td>Theroetical Foundation of TESOL</td>
<td>Introduction to key concepts and issues in teaching English to speakers of other languages. Topics covered may include nature of first-and-second acquisition, role of input and instruction in language learning, and evaluation of approaches to teaching and research.</td>
<td>3.0</td>
<td>(0-3-0)</td>
<td>Fall, Spring, Summer</td>
<td>May not be enrolled in one of the following Class(es): Liberal Arts, English</td>
<td>HU 2910</td>
</tr>
<tr>
<td>HU 3962</td>
<td>TESOL Methods and Materials</td>
<td>Enhance understanding and awareness of the developmental stages and needs of English language learners in various learning contexts. Show how to adjust, modify, and manipulate instructional techniques and materials to accommodate the linguistic and cognitive needs of English learners.</td>
<td>3.0</td>
<td>(0-3-0)</td>
<td>Fall, Spring</td>
<td>May not be enrolled in one of the following Class(es): Liberal Arts, English</td>
<td>HU 2910</td>
</tr>
<tr>
<td>HU 3963</td>
<td>Assessment and Testing in TESOL</td>
<td>This course covers basic principles and approaches in the assessment and testing of English as a second or foreign language in various instructional contexts. Topics covered may include test construction and adaptation and the application of this knowledge to evaluating tests.</td>
<td>3.0</td>
<td>(0-3-0)</td>
<td>Fall, Spring</td>
<td>May not be enrolled in one of the following Class(es): Liberal Arts, English</td>
<td>HU 2910</td>
</tr>
<tr>
<td>HU 3964</td>
<td>Cross-Cultural Aspects of TESOL</td>
<td>Course examines those places where language and culture come together to affect our interactions; concentrating on areas particularly important to language teaching, learning, and usage. Topics may include introduction to pragmatics, politeness theory, and conversational politeness strategies.</td>
<td>3.0</td>
<td>(0-3-0)</td>
<td>Fall, Spring</td>
<td>May not be enrolled in one of the following Class(es): Liberal Arts, English</td>
<td>HU 2910</td>
</tr>
<tr>
<td>HU 4050</td>
<td>Special Topics</td>
<td>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.</td>
<td>variable to 6.0</td>
<td>May be repeated</td>
<td>Fall, Spring, Summer</td>
<td>Permission of instructor required</td>
<td></td>
</tr>
<tr>
<td>HU 4060</td>
<td>Humanities Workshop</td>
<td>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.</td>
<td>variable to 6.0</td>
<td>May be repeated</td>
<td>Fall, Spring, Summer</td>
<td>Permission of instructor required</td>
<td></td>
</tr>
<tr>
<td>HU 4071</td>
<td>Senior Seminar in English and Liberal Arts</td>
<td>A capstone seminar in which students develop, deepen and present individual research and/or creative projects which demonstrate the skills and knowledge they have acquired in the English and/or Liberal Arts major programs.</td>
<td>3.0</td>
<td>(0-3-0)</td>
<td>Fall</td>
<td>Must be enrolled in one of the following Major(s): Liberal Arts, English</td>
<td>HU 3274 or HU 3275</td>
</tr>
</tbody>
</table>

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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. Course offered third year beginning 2010-2011.

Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring - 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 representation of modern technology in literature, film, and authentic documents from French, German, and Hispanic language communities. Students read texts in German and in English translation. Course offered every third year beginning 2008-2009.

Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Pre-Requisite(s): HU 3274 or HU 3275

HU 4281 - Modern Language Seminar IV-French
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. Course offered every third year beginning 2009-2010.

Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring
Pre-Requisite(s): HU 3284 or HU 3285

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. Course offered every third year beginning 2009-2010.

Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, 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. Course offered every third year beginning 2010-2011.

Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring
Pre-Requisite(s): HU 3284 or HU 3285

HU 4291 - Level IV Modern Language Seminar I-Spanish
Language and power. Critical study of the representation of politics, economies, and social institutions in literature, film, and authentic texts 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: On Demand
Pre-Requisite(s): HU 3294 or HU 3295

HU 4292 - Level IV 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: On Demand
Pre-Requisite(s): HU 3294 or HU 3295

HU 4293 - Level IV 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: On Demand
Pre-Requisite(s): HU 3294 or HU 3295

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

HU 4626 - International Technical Communication
Focuses on international workplace communication. Introduces theories of globalization. Topics may include localization, contrastive rhetoric, technical translation, and international usability.

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
Pre-Requisite(s): HU 2600

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

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
Restrictions: Must be enrolled in one of the following Major(s): Scientific & Tech Comm (BS), Scientific & Tech Comm (BA)
Pre-Requisite(s): HU 3120 and HU 2600

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HU 4642 - Advanced Topics in Media
Critical and applied topics in advanced media, theory and development. Topics may include game design, mobile media, color, photography, film, or graphic design.
Credits: 3.0
Lec-Rec-Lab: (0-2-3)
Semesters Offered: On Demand
Restrictions: Permission of instructor required

HU 4690 - Special Topics in Technical and Professional Communication
In-depth examination of selected topics in scientific and technical communication, or on professional and workplace writing in selected genres such as reports, proposals, or whitepapers.
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

HU 4693 - Science Writing
Introduces writing, research, and editing that contribute to a public understanding of science. Possible topics: health, environment, medicine, public policy. All majors welcome.
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 1015 or UN 2001

HU 4694 - Grant Writing
Introduces fundamentals of grant proposal writing/research. Possible topics: writing for nonprofits, grant writing in various disciplines, researching funding sources. All majors welcome.
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): UN 1015 or UN 2001

HU 4695 - Digital Rhetorics
Historical, ethical, and social implications of digital rhetorics, investigating how rhetorics figure in digital contexts with special attention to digital content and programmatic form. Critical understanding of rhetorical analysis through readings, discussion, and research of contemporary issues in digital rhetorics.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Major(s): English, Scientific & Tech Comm (BS), Rhetoric & Tech Communication, Scientific & Tech Comm (BA), Communication, Culture & Media, Liberal Arts; May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): HU 2642

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: On Demand

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

HU 4725 - Existentialism and Phenomenology
Introduction to the philosophical traditions of existentialism and phenomenology. Topics might include: the nature of human existence and of freedom; the importance of world, self, anxiety, death, and authenticity; and the foundations of knowledge, experience and meaning.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2013-2014 academic year

HU 4800 - Media and Globalization
Examines the development of modern international communication systems, the rise of transnational media industries and technologies, and debates about their global impacts.
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

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

HU 4961 - Practicum in TESOL
Observation, case studies, tutoring, instructional assistance, and supervised teaching experience in English to speakers of other languages.
Credits: variable to 6.0; Repeatable to a Max of 6
Semesters Offered: Fall, Spring, Summer
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): HU 3962

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 0030 - Team Approach for College Algebra
Collaborative approach to the study of mathematics. Helps students with MA1030 and gives experience in team problem solving. Credit does not count toward graduation.
Credits: 0.0; May be repeated
Semesters Offered: Fall, Spring, Summer
Co-Requisite(s): MA 1030
MA 0031 - Team Approach for College Algebra II
Collaborative approach to the study of mathematics. Helps students with MA1031 and gives experience in team problem solving. Credit does not count toward graduation.
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, Spring
Restrictions: Must be enrolled in one of the following Major(s): Comm and Culture Studies, Theatre & Electr. Media Perp., Theatre & Entertain Tech (BS), Theatre & Entertain Tech (BA), Scientific & Tech Comm (BS), Psychology, Sports and Fitness Management, Social Sciences, Liberal Arts with History Opt, Scientific & Tech Comm (BA), Humanities, Liberal Arts

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, Summer
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: (0-4-0)
Semesters Offered: Fall, Spring, Summer
Pre-Requisite(s): ACT Mathematics >= 19 or SAT Mathematics >= 500

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, Summer
Restrictions: May not be enrolled in one of the following College(s): College of Engineering
Pre-Requisite(s): MA 1032 or MA 1031 or ACT Mathematics >= 26 or SAT Mathematics >= 600

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: (0-3-1)
Semesters Offered: Fall, Spring
Pre-Requisite(s): MA 1032 or MA 1031 or ACT Mathematics >= 29 or SAT Mathematics >= 650

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: (0-4-1)
Semesters Offered: Fall, Spring, Summer
Pre-Requisite(s): MA 1032 or MA 1031 or ACT Mathematics >= 26 or SAT Mathematics >= 600

MA 1600 - Introduction to Scientific Simulation
Introduction to simulation, a powerful computational tool for many scientific problems. Case studies and projects will be drawn from various fields. Prior programming experience is not required; all necessary computational skills will be developed in the course.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Spring
Pre-Requisite(s): MA 1160 or MA 1161

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 1990 - Elementary Mathematics Topics
Students study a particular area in mathematics, ordinarily not covered in existing courses. Intended for first-year students.
Credits: variable to 6.0; Repeatable to a Max of 6
Restrictions: Permission of instructor required

MA 2010 - Recreational Mathematics
Topics include such things as fair division, time travel, maze threading, logic puzzles and paradoxes, famous math problems and solutions, cryptarithmic 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: On Demand

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: (0-3-1)
Semesters Offered: Fall, Spring, Summer
Pre-Requisite(s): MA 1160 or MA 1161 or MA 1135

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 MA2320 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): Mathematics, Computer Science
Pre-Requisite(s): MA 1160 or MA 1161

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): Mathematics, Computer Science
Co-Requisite(s): MA 3521
Pre-Requisite(s): 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 1160 or MA 1161

MA 2600 - Scientific Computing
Use of mathematical modeling and computer simulation to solve scientific problems. Includes introduction to elementary numerical methods (numerical integration, solution of linear systems, solution of nonlinear equations, optimization) and to computer programming. Requires programming project(s).
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): MA 2160 and (MA 2320 or MA 2321 or MA 2330)

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 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 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: 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 1030

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 1160 or MA 1161

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 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.
Credits: 4.0
Lec-Rec-Lab: (0-3-1)
Semesters Offered: Fall, Summer
Pre-Requisite(s): MA 2160

MA 3202 - Introduction to Coding Theory
Transmission via noisy channels, hamming distance, linear codes, the ISBN-code, encoding and decoding, finite fields, Reed-Solomon codes, deep space communication, the compact disk code, sphere packing bound, hamming codes, 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, Summer
Pre-Requisite(s): MA 2320 or MA 2321 or MA 2330

MA 3310 - Introduction to Abstract Algebra
Introduction to proofs in algebra. Topics include elementary number theory (induction, binomial theorem, fundamental theorem of arithmetic, Euclidean algorithm, congruences, Fermat's theorem), group theory (subgroups, cyclic groups, generators, Lagrange's theorem, normal groups, homomorphisms, quotients), ring theory (domains, fields, polynomials, homomorphisms).
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Summer
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 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): Mathematics, Computer Science
Pre-Requisite(s): 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): Mathematics, Computer Science
Pre-Requisite(s): MA 2321

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 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 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 2160

MA 3715 - Biostatistics
Introduction to the design and analysis of statistical studies in the health and life sciences. Topics include study design, descriptive and graphical methods, probability, inference on means, categorical data analysis, and linear regression.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): MA 1135 or MA 1160 or MA 1161

MA 3720 - Probability
Introduction to probabilistic methods. Topics include probability laws, counting rules, discrete and continuous random variables, expectation, joint distributions, and limit theorems.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Summer
Pre-Requisite(s): MA 3160

MA 3740 - Statistical Programming and Analysis
Use of statistical packages R and SAS to process and analyze data. Topics include: data import and manipulation, production of copy quality graphs, use of basic statistical methods, and some advanced programming techniques.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): MA 2710 or MA 2720 or MA 3710
MA 3810 - Introduction to Actuarial Mathematics
Nominal and effective rates of interest, present value, discount, annuities certain, sinking funds, bonds, yield rates, and amortization schedules. Financial calculator skills for professional exams. Introduction to derivative securities and arbitrage pricing. May include other topics on the FM exam.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): MA 3160(C)

MA 3811 - Actuarial Exam Workshop
Topics from the Society of Actuaries professional examinations, primarily financial mathematics and probability. Review, preparation, and practice using SOA exams and other materials.
Credits: 1.0; Repeatable to a Max of 4; Graded Pass/Fail Only
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Fall, Spring
Pre-Requisite(s): MA 3160

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 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 3999 - Intermediate Topics in Mathematics
Students study a particular area in mathematics, not ordinarily covered in existing courses. Intended for third-year students.
Credits: variable to 4.0; Repeatable to a Max of 6
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 4310 - Abstract Algebra
Detailed study of abstract algebra: elementary number theory (congruences, quadratic residues, arithmetic functions), group theory (monoids, permutation groups, homomorphisms, quotients, Lagrange's theorem, finite abelian groups, Sylow's theorems), ring theory (domains, prime and maximal ideals, quotients, PID's), splitting fields, finite fields.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
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 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 3160

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 2320 or MA 2321 or MA 2330) and MA 3160 and MA 3450

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 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 3160 and (MA 2320 or MA 2321 or MA 2330)
### MA 4535 - Nonlinear Dynamics and Chaos
Ordinary differential equations and dynamical systems via a modern geometric approach, including physical and engineering applications. May include chaotic phenomena and fractals.

**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 3160

### MA 4610 - Numerical Linear Algebra
Derivation and analysis of algorithms for problems in linear algebra. Covers floating point arithmetic, condition numbers, error analysis; solution of linear systems (direct and iterative methods), eigenvalue problems, least squares, singular value decomposition. Includes a review of elementary linear algebra and the use of 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 - Numerical Methods for PDEs
Derivation, analysis, and implementation of numerical methods for partial differential equations; applications to fluid mechanics, elasticity, heat conduction, acoustics, or electromagnetism.

**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 3160

### MA 4700 - Mathematical Statistics I
Covers joint probability distributions, functions of random variables, sampling and limiting distributions, introduction to parameter estimation.

**Credits:** 3.0  
**Lec-Rec-Lab:** (0-3-0)  
**Semesters Offered:** Fall  
**Pre-Requisite(s):** MA 2710 or MA 2720 or MA 3710

### MA 4700 - Mathematical Statistics II
Continuation of MA4760. Theory of point and interval estimation; properties of estimators, theory of hypothesis testing; with applications.

**Credits:** 3.0  
**Lec-Rec-Lab:** (0-3-0)  
**Semesters Offered:** Spring  
**Pre-Requisite(s):** MA 4760

### MA 4780 - Time Series Analysis and Forecasting
Topics in time series analysis and forecasting. Trend analysis, smoothing, Box-Jenkins models, model selection and testing, time series regression.

**Credits:** 3.0  
**Lec-Rec-Lab:** (0-3-0)  
**Semesters Offered:** Spring  
**Pre-Requisite(s):** MA 2710 or MA 2720 or MA 3710

### MA 4790 - Predictive Modeling
Application, construction, and evaluation of statistical models used for prediction and classification. Topics include data visualization and exploratory methods, the normal theory regression model, logistic and Poisson regression, linear and quadratic discriminant analysis, and classification with logit models.

**Credits:** 3.0  
**Lec-Rec-Lab:** (0-3-0)  
**Semesters Offered:** Spring  
**Pre-Requisite(s):** MA 3740 or MA 4710 or MA 4720 or MA 4780

### MA 4810 - Life Contingencies
Life tables. Basic forms of life insurance, life annuities, gross and net premiums, reserves, cash values, expense loadings, and commutation functions. Joint-life, last survivor, and reversionary functions. Derivative Securities, hedging. May include other topics on MLC and MFE exams.

**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 and MA 3810

### MA 4820 - Loss Distributions and Credibility Theory
Loss distribution studies probability distributions that are used for modeling the outcomes of insurance claims. Credibility theory addresses methods for updating statistical estimates as new data becomes available. May include other topics on the C exam.

**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 4905 - Methods of Teaching Mathematics
This course focuses on trends and standards in secondary school mathematics education, with an emphasis on methods and materials for effectively supporting and assessing middle and high school learning. Requires admission to teacher education program.

**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):** ED 4700(C)

### 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.
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 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. Prerequisite of MA2160 with a grade of C or better is required.
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): Sch of Forest Res & Envir Sci, College of Engineering
Pre-Requisite(s): MA 2160

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
Restrictions: Must be enrolled in one of the following College(s): Sch of Forest Res & Envir Sci, College of Engineering
Pre-Requisite(s): MEEM 2110

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 and CH 1150 and CH 1151

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): Mechanical Engineering, Industrial Technology, Biomedical Engineering, Engineering-Mechanical Design
Pre-Requisite(s): ENG 1102 or TE 1020 and (MY 2100(C) or MET 1540(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
Restrictions: Must be enrolled in one of the following Major(s): Mechanical Engineering
Pre-Requisite(s): PH 2100 and (MEEM 2110 or ENG 2120) and MA 3160(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 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, control-volume analyses, 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) and (MA 3520 or MA 3521 or MA 3530 or MA 3560)

MEEM 3220 - Energy Laboratory
Introduction to measurement techniques 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

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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

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 2320 or MA 2321 or MA 2330) and (MA 3520 or MA 3521 or MA 3530 or MA 3560)

MEEM 3900 - Engineering Design Processes
This course introduces methods for concurrent design, manufacturing, and assembly that will be utilized later in their Senior Capstone Design or Enterprise project experience. Course topics will include thinking styles, teamwork, creative problem solving, brainstorming, Pugh method, technical report preparation, economic decision making, quality, analytical and experimental design optimization, DFA, DFM, GD&T, codes and fasteners, robust engineering, engineering ethics, patents and IP, and innovation in the workplace. A one semester 'paper only' design project is utilized to enhance the learning outcomes.
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)

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 department required; Must be enrolled in one of the following Major(s): Mechanical Engineering, Mechanical Engineering; 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: Spring
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
Restrictions: May not be enrolled in one of the following Level(s): Graduate
Pre-Requisite(s): MEEM 2150

MEEM 4170 - Failure of Materials 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. Credit may not be received for both MEEM4180 and BE3750.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
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, thermodynamic power cycles, solar energy, wind energy, and energy storage. No credit for both MEEM4200 and MEEM5290.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Level(s): Graduate
Pre-Requisite(s): MEEM 3230(C) or CM 3230 or ENG 3200 or MY 3100

MEEM 4210 - Computational Fluids Engineering
Introduces computational methods used to solve fluid mechanics, and thermal transfer problems. Discusses theoretical and practical aspects. Modern computer-based tools are used to reinforce principles and introduce advanced topics in fluid mechanics, and thermal transport.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Level(s): Graduate
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: Spring
Restrictions: Must be enrolled in one of the following Level(s): Graduate
Pre-Requisite(s): MEEM 3210

MEEM 4230 - Compressible Flow/Gas Dynamics
Fundamentals of one-dimensional gas dynamics, including flow in nozzles and diffusers, normal shocks, frictional flows, and flows with heat transfer or energy release; introduction to oblique shocks.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): MEEM 3210

MEEM 4240 - Combustion & Air Pollution
Introduces sources of emissions from combustion, applies thermochemical principles to model the formation of pollutants, and identifies impacts of air pollutants on the environment and human health. Addresses pollution regulation and societal impacts including emissions, climate change, and air quality.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, 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
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 4260 - Fuel Cell Technology
In this course, after fuel cell technology basics and operating principles, fuel cell performance will be briefly described from energy and thermodynamic viewpoints. Major types of fuel cells will be discussed: Polymer Electrolyte Membrane Fuel Cell (PEMFC), Direct Methanol Fuel Cells (DMFC), Alkaline Fuel Cells (AFC), Phosphoric Acid Fuel Cell (PAFC), Molten Carbonate Fuel Cell (MCFC) and Solid Oxide Fuel Cell (SOFC). The balance of the fuel cell power plant, thermal system design and analysis will be discussed that affect the power generation. Finally, the components needed, issues related, and pertinent analysis will be covered to delivering electric power generated from the fuel cell.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following College(s): College of Engineering; Must be enrolled in one of the following Class(es): Senior
Pre-Requisite(s): MEEM 3230 or CM 3110

MEEM 4295 - Introduction to Propulsion Systems for Hybrid Electric Vehicles
Hybrid electric vehicle analysis will be developed and applied to examine the operation, integration, and design of powertrain components. Model based simulation and design is applied to determine vehicle performance measures in comparison to vehicle technical specifications. Power flows, losses, energy usage, and drive quality are examined over drive-cycles via application of these tools.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Summer
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
Pre-Requisite(s): (MEEM 2200 or ENG 3200) and MEEM 4700 or EE 4261 or EE 3261

MEEM 4296 - Introduction to Propulsion Systems for Hybrid Electric Vehicles Laboratory
Hybrid electric vehicles and their powertrain components will be examined from the aspects of safety, testing and analysis, energy conversion, losses, and energy storage, and vehicle technical specifications and vehicle development process. The lab will culminate with vehicle testing to perform power flow and energy analysis during a drive-cycle.
Credits: 2.0
Lec-Rec-Lab: (0-1-2)
Semesters Offered: Fall, Summer
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
Pre-Requisite(s): MEEM 4295(C) or EE 4295(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, Mechanical Eng-Eng Mechanics, Engineering-Manufacturing; May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): ENG 1102

MEEM 4404 - Mechanism Synthesis/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: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring
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 4450 - Vehicle Dynamics
This course will develop the models and techniques needed to predict the performance of a road vehicle during drive off, braking, ride, and steering maneuvers. Topics to be covered include: acceleration and braking performance, drive train performance including an introduction to hybrid electric power train architecture, vehicle handling, suspension modeling, tire models, and steering control. Matlab will be used as a computational tool for implementation of the models.
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
Pre-Requisite(s): (MEEM 3502 and MEEM 3000) or (EE 3305 and MEEM 2700)

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: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): MEEM 2500

MEEM 4611 - 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, Spring
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, Spring
Pre-Requisite(s): MEEM 3700(C) and MEEM 3502(C)

MEEM 4630 - Human Factors
The usability of products and systems can be improved by considering human capabilities during their design. This course explores both the psychological and physical characteristics of human beings. It then presents how to apply human factors principles to the design process. Degree credit cannot be received for both MEEM4630 and SSE3400.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following College(s): College of Engineering; May no be enrolled in one of the following Class(es): Freshman, Sophomore, Junior

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: (0-3-0)
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 MEEM650.
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): MA 3710 or MA 3720 or MA 2710 or MA 2720

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 services and products are created and how they are delivered to customers.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring
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 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): MEEM 3000 and 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 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, Spring
Pre-Requisite(s): MEEM 4700(C)

MEEM 4720 - Space Mechanics
This course presents the vector-based solution of the two-body problem and the solution for Kepler's equations. The course will also cover basic orbit determination techniques, impulsive orbit transfer maneuvers, interplanetary trajectories, ground tracks, and rendezvous problems.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Level(s): Graduate
Pre-Requisite(s): MEEM 2700

MEEM 4750 - Distributed Embedded Control Systems
This course will develop an understanding for the design and application of embedded control systems. Topics to be covered include: embedded system architecture, model-based embedded system design, real-time control, communication protocols, signal processing, and human machine interface. Embedded applications in advanced hybrid electric vehicles will also be introduced.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following College(s): College of Engineering
Pre-Requisite(s): MEEM 4700 or EE 4261 or EE 3261

MEEM 4810 - Introduction to Aerospace Engineering
Introductory course on topics relevant to aerospace engineering and science. Topics include history, properties of the atmosphere, the solar system, atmospheric and space vehicles, mission design, and vehicle design and performance.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): (MEEM 2150 or ENG 2120) and (MEEM 3210 or ENG 3200)

MEEM 4901 - Senior Capstone Design I
Students work in teams on "open-ended" engineering capstone design projects - most with industrial sponsors - developing original and creative solutions to real engineering problems.
Credits: 2.0
Lec-Rec-Lab: (0-0-6)
Semesters Offered: Fall, Spring
Restrictions: Must be enrolled in one of the following Major(s): Mechanical Engineering
Pre-Requisite(s): MEEM 3000(C) and MEEM 3502(C) and MEEM 3900

MEEM 4911 - Senior Capstone Design II
Design projects started in MEEM4901 are completed and evaluated using computer-aided engineering methods, physical models, and/or prototypes as appropriate.
Credits: 2.0
Lec-Rec-Lab: (0-0-6)
Semesters Offered: Fall, Spring
Restrictions: Must be enrolled in one of the following Major(s): Mechanical Engineering
Pre-Requisite(s): MEEM 4901 and MEEM 3000(C) and MEEM 3502(C) and MEEM 3900

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

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 department required; Must be enrolled in one of the following Major(s): Mechanical Eng-Eng Mechanics, Mechanical Engineering; May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior

Mechanical Engg Technology

MET 1020 - Technology Computer Applications
Introductory course intended to develop knowledge of computer modeling techniques such as solid modeling, spreadsheet, word processing, presentation, and project time line software utilized throughout the technology curriculum.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Fall

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
Pre-Requisite(s): CH 1000 or (CH 1150 and CH 1151)
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<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
<th>Prerequisite(s)</th>
<th>Semesters Offered</th>
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<tbody>
<tr>
<td>MET 2120</td>
<td>Statics and Strength of Materials</td>
<td>4.0</td>
<td>(MA 1160(C) or MA 1161(C)) and (PH 1140 or PH 1110)</td>
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<td>MET 2130</td>
<td>Dynamics</td>
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<tr>
<td>MET 2153</td>
<td>Machine Tool Fundamentals and Applications</td>
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<td>MET 2400</td>
<td>Practical Applications in Parametric Modeling</td>
<td>3.0</td>
<td>MA 2710 or MA 2720 or MA 3710</td>
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<td>MET 3242</td>
<td>Machine Design I</td>
<td>3.0</td>
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<td>MET 3250</td>
<td>Applied Fluid Mechanics</td>
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<tr>
<td>MET 3361</td>
<td>Applied Thermodynamics and Heat Transfer</td>
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<td>MET 3451</td>
<td>Machine Design II</td>
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<td>MET 4210</td>
<td>Applied Quality Techniques</td>
<td>3.0</td>
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<td>MET 4377</td>
<td>Applied Fluid Power</td>
<td>3.0</td>
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<td>MET 4390</td>
<td>Internal Combustion Engines</td>
<td>3.0</td>
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<td>MET 4400</td>
<td>Simulation Methods</td>
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<td>MET 4460</td>
<td>Product Design and Development</td>
<td>3.0</td>
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<tr>
<td>MET 4510</td>
<td>Lean Manufacturing and Production Planning</td>
<td>3.0</td>
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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: Spring
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): MEEM 2500 and MET 2400

MET 4585 - Facilities Layout and Safety Design
Examines the optimization concepts and safety topics necessary to design a low risk, high efficiency manufacturing facility layout. The focus will be on quantitative tools, flow analysis techniques, hazard recognition and resource selection.
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): MET 2400 and MET 3451

MET 4660 - CAE and FEA Methods
Comprehensive use of both computer derived solutions and experimental validation of analytical and finite element solutions using methods such as strain gage testing.
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): MET 2400 and MET 4460

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; Must be enrolled in one of the following Class(es): Senior
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: (0-2-2)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): MEEM 2500

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
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): MET 3361(C)

MET 4996 - Special Topics in Mechanical Engineering Technology
Selected additional topics of interest in Mechanical Engineering Technology based on student and faculty demand and interest. May be a tutorial, seminar, workshop, project, or class study.
Credits: variable to 3.0; Repeatable to a Max of 6
Semesters Offered: On Demand
Restrictions: Permission of instructor required; Must be enrolled in one of the following Major(s): Mechanical Engineering Tech; Must be enrolled in one of the following Class(es): Senior

MET 4997 - Independent Study in Mechanical Engineering Technology
Independent study of an approved topic under the guidance of a Mechanical Engineering Technology faculty member. May be either an academic, design, or research problem/project.
Credits: variable to 3.0; Repeatable to a Max of 6
Semesters Offered: On Demand
Restrictions: Permission of instructor required; Must be enrolled in one of the following Major(s): Mechanical Engineering Tech; Must be enrolled in one of the following Class(es): Senior

MET 4998 - Undergraduate Research in Mechanical Engineering Technology
An undergraduate research experience in Mechanical Engineering Technology. Under the guidance of a Mechanical Engineering Technology faculty member, students work on a selected/approved research problem or work directly with faculty on active research projects/grants. May require more than one semester to complete.
Credits: variable to 6.0; Repeatable to a Max of 6
Semesters Offered: On Demand
Restrictions: Permission of instructor required; Must be enrolled in one of the following Major(s): Mechanical Engineering Tech; Must be enrolled in one of the following Class(es): Senior

MET 4999 - Professional Practice 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 CMfgT (Certified Manufacturing Technologist) exam.
Credits: 1.0; Graded Pass/Fail Only
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Fall, Spring
Restrictions: Must be enrolled in one of the following Class(es): Senior

Management

MGT 2000 - Team Dynamics and Decision Making
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

MGT 3000 - 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

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MGT 3100 - Leadership Development
Assesses students' current knowledge, abilities and values relevant to leadership and guides students in developing and implementing plans for new leadership abilities.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring - Offered alternate years beginning with the 2008-2009 academic year
Restrictions: May not be enrolled in one of the following Class(es): Freshman

MGT 3650 - Intellectual Property Management
Covers principles of intellectual property lawy, addressing managerial and policy issues in copyright, trademark, trade secret, and patents. Readings and discussions also cover how these property and legal systems impact the balance between property exclusivity, technological innovation and public access.
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

MGT 3800 - Entrepreneurship
Covers management issues associated with establishing a successful new enterprises as a small businesses or part of an existing firm. Emphasizes learning through creation of a business plan as well as case studies that develop an 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

MGT 4000 - Strategic Management
Introduces 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 or MIS 2000) and (BA 3400 or FIN 3000)
and (BA 3610 or OSM 3000) and (BA 3700 or MGT 3000) and (BA 3800 or MKT 3000)

MGT 4100 - 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. Examine 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
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): (BA 3700 or MGT 3000) and EC 3100(C)

MGT 4500 - Managing Change in Organizations
Studies organizational theory with an emphasis on managing change in organizations. Examines forces for change in the external environment, methods 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 2012-2013 academic year
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore

MGT 4600 - Management of Technology and Innovation
Uses an evolutionary process perspective that examines how technology strategy evolves from underlying technology competences and capabilities, 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: May not be enrolled in one of the following Class(es): Freshman, Sophomore

MGT 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 or MGT 4600(C)

MGT 4700 - 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 or MGT 3000

MGT 4990 - 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: variable to 3.0; Repeatable to a Max of 6
Semesters Offered: On Demand
Restrictions: Permission of instructor required
Pre-Requisite(s): BA 3700 or MGT 3000
Management Information Systems

MIS 2000 - IS/IT Management
Focuses on the theory and application of the information-systems discipline within an organizational context, and identifies the roles of management, users, and information systems professionals. Covers the use of information systems and implications for decision support to improve business processes, and addresses the ethical, legal, and social issues of IT.
Credits: 3.0
Lec: (0-3-0)
Semesters Offered: Fall, Spring, Summer
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): BUS 1100 or BA 1100 or CS 1121 or CS 1131 or ENG 1101 or (ENG 1001 and ENG 1100) or SAT 1200

MIS 2100 - Introduction to Business Programming
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: Spring

MIS 2200 - Web Programming
Covers technologies, tools, and environments related to the development of web-enabled business solutions. Topics include the development environment for web-based solutions, key development technologies, desirable development practices, and design, programming, debugging and testing methods.
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): BA 2200 or MIS 2100 or CS 1121 or CS 1131

MIS 3000 - Business Process Analysis
Studies business decision management discipline using business rules, process models (e.g. flowcharts, unified modeling language, swim lanes), and information systems to improve efficiency and effectiveness. Emphasis on industry standards and business process management used to increase productivity.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall - Offered alternate years beginning with the 2011-2012 academic year
Pre-Requisite(s): MIS 2000 or BA 3200

MIS 3100 - 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
Pre-Requisite(s): MIS 2000(C) or BA 3200

MIS 3200 - 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: Spring
Pre-Requisite(s): MIS 2000(C) or BA 3200

MIS 3300 - Telecommunications
Introduces students to telecommunication 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: Spring - Offered alternate years beginning with the 2012-2013 academic year
Pre-Requisite(s): MIS 2000(C) or BA 3200

MIS 3400 - Business Intelligence
Focuses on generation and interpretation of business analytics relative to organizational decision making. Includes core skills necessary for constructing data retrieval queries in a relational database environment.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2011-2012 academic year
Pre-Requisite(s): MIS 2000 or BA 3200

MIS 3500 - User-Centered Design
Studies user-centered design in development of effective interface solutions for business needs. Content may include input/output devices, user modeling, help and documentation, social issues, and usability evaluation. Emphasis on how interface design addresses human capabilities and capacities.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall - Offered alternate years beginning with the 2012-2013 academic year
Pre-Requisite(s): MIS 2000 or BA 3200

MIS 3600 - Information Regulatory Compliance
Focuses on understanding government regulations directly relevant to information systems practitioners and end users for the secure management of IT assets and capabilities. Coverage may include: global, national, and local regulations; security concerns; and individual, team, and organizational responsibilities (e.g. social engineering issues).
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2012-2013 academic year
Pre-Requisite(s): MIS 2000 or BA 3200

MIS 4000 - 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 - Offered alternate years beginning with the 2010-2011 academic year
Restrictions: Must be enrolled in one of the following Class(es): Senior
Pre-Requisite(s): (MIS 3100 or BA 3210) and (MIS 3200 or BA 3220)
MIS 4100 - Information Systems Projects
MIS capstone course. Previous completion of required MIS coursework expected. Applies IS practices and artifacts 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 Class(es): Senior
Pre-Requisite(s): (BA 3210 or MIS 3210) and (BA 3220 or MIS 3000 or MIS 3200)

MIS 4990 - Special Topics in Management Information Systems
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: variable to 3.0; Repeatable to a Max of 6
Semesters Offered: On Demand
Pre-Requisite(s): MIS 2000 or BA 3200

Marketing

MKT 3000 - 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: (3-0-3)
Semesters Offered: Fall, Spring, Summer
Restrictions: May not be enrolled in one of the following Class(es): Freshman

MKT 3200 - Consumer Behavior
Introduces students to the general concepts, processes, and variables pertinent to consumers’ decision making and lifestyle choices. Discussions will be based on a variety of disciplines: psychology, sociology, economics, and anthropology.
Credits: 3.0
Lec-Rec-Lab: (3-0-3)
Semesters Offered: Fall
Pre-Requisite(s): BA 3800 or MKT 3000

MKT 3400 - Integrated Marketing Communications
Discusses how a variety of marketing communication methods, such as advertising, public relations, sales promotion, point-of-purchase, and direct marketing are developed, implemented, and evaluated in an integrative manner.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): BA 3800 or MKT 3000

MKT 3600 - Marketing Research
Focuses on the application of the marketing research in marketing decision-making. Topics include survey methodology, research design, statistical analysis of data, and report writing.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring
Pre-Requisite(s): (MA 2710 or MA 2720 or MA 3710 or BUS 2100 or BA 2100) and (BA 3800 or MKT 3000)

MKT 3800 - Marketing Strategy
Focuses on the formulation and the implementation of marketing strategies. Topics include the analyses of business environment as well as marketing program development and evaluation.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): MKT 3000 or BA 3800

MKT 4000 - New Products Marketing
Explores strategic aspects of new product management. Topics include the process of new product development, product life-cycle management, brand management, and product commercialization strategy.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): MKT 3000 or BA 3800

MKT 4100 - 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, Spring, Summer
Pre-Requisite(s): BA 3800 or MKT 3000

MKT 4200 - Business to Business Marketing
Emphasis is on the firm's behavior and decision-making. Topics include the foundation of business value creation, business marketing programs development, and inter-firm relationship management.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring
Pre-Requisite(s): BA 3800 or MKT 3000

MKT 4300 - Global Marketing
Discusses the critical elements of international marketing strategy: socio-politico-economic environment, global consumer culture, entry strategy, and global marketing mix. Utilizes cases and examples in order for students to better understand the globalized marketplace.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring
Pre-Requisite(s): MKT 3000 or BA 3800

MKT 4400 - Services Marketing
Focuses on the difference from the marketing of products. Discusses various services in conjunction with their marketing strategy to enhance service quality and customer satisfaction. Covers both pure services and service-laden businesses: industrial products, high tech products, and durable goods.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): MKT 3000 or BA 3800

MKT 4500 - Introduction to Digital Marketing
The class will include, but is not limited to: online video lectures, interactive chats, blogging, completing digital marketing plans and an Internet Marketing textbook supported by a student web site. Basic familiarity with the internet, search engines and social media is assumed.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): MKT 3000 or BA 3800
MKT 4990 - Special Topics in Marketing
Examines current issues in marketing. Topics are selected based on the interest to faculty and students
Credits: variable to 3.0; Repeatable to a Max of 6
Semesters Offered: On Demand
Restrictions: Permission of instructor required
Pre-Requisite(s): MKT 3000

Materials Science & Engrg

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 1112 or CH 1122 or (CH 1150 and CH 1151) or (CH 1160 and CH 1161)

MY 2110 - Introduction to Materials Science and Engineering II
Continuation of MY2100 designed to address "core competencies" in the materials discipline. Materials processing methods are used as a vehicle to master concepts such as conservation principles, crystallography, imperfections, phase diagrams, microstructure, and develop mathematical skills and introduce computational tools.
Credits: 3.0
Lec-Rec-Lab: (0-2-3)
Semesters Offered: Spring
Pre-Requisite(s): MY 2100

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 and MY 2110

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 and (MA 3520 or MA 3521 or MA 3530 or MA 3560)

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, and diffraction. 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 and MY 2110

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, spectroscopy, 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 3000

MY 3292 - Light and Photonic Materials
Material properties controlling light wave propagation in optical crystals and optical wave guides. Photonic crystals and photonic devices based on electrical, magnetic, and strain effects.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Major(s): Physics, Applied Physics, Electrical Engineering, Materials Science and Engrg; Must be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): PH 2200 or EE 2190 or EE 3140

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 3701 - Introduction to Semiconductor Materials Science and Engineering
An introduction to the materials science and engineering of semiconductors. Topics include: semiconductor material electronic, thermal, and optical properties, how these properties are modified, how elementary devices made from these materials operate, and how device function depends on materials selection and processing.
Credits: 2.0
Lec-Rec-Lab: (2-0-0)
Semesters Offered: Fall
Pre-Requisite(s): PH 2400

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 4155 - Composite Materials
Mechanistic aspects of property development in metal, ceramic, and polymeric composites. The role of composite architecture, processing, and microstructure on properties.
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): MY 2100

MY 4165 - Corrosion and Environmental Effects
Mechanisms of corrosion processes, electrochemical and oxidation kinetics, and fundamentals of corrosion engineering.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Pre-Requisite(s): MY 2100

MY 4180 - Advanced Physical Metallurgy
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: On Demand
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
Introduction to scanning electron microscope (SEM) theory and application. Topics will include electron beam and image formation, beam-specimen interactions, and x-ray microanalysis. Course material will be of interest to biologists, chemists, and engineers. Completion of MY4201 is required for independent use of the equipment.
Credits: 2.0
Lec-Rec-Lab: (2-0-0)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es):
Freshman, Sophomore

MY 4201 - Introduction to Scanning Electron Microscopy Laboratory
A laboratory course providing hands-on practical training leading to independent use of the scanning electron microscope (SEM).
Credits: 1.0
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring
Restrictions: Must be enrolled in one of the following Major(s): Materials Science and Engnr
Pre-Requisite(s): MY 4200(C)

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 4300 - Mechanical Behavior of Materials
An introduction to the deformation and fracture behavior of materials. Topics include multiaxial stress and strain, elastic and plastic deformation, hardening mechanisms, viscoelasticity, fracture, fatigue, creep, and microstructure/property relationships.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Pre-Requisite(s): MY 2100 and (MEEM 2150 or ENG 2120)

MY 4310 - Practical Scanning Probe Microscopy for Undergraduates
In this course, students will learn the design and fundamental physics behind scanning probe microscopy (SPM) techniques. Laboratories will include basic training in the operation of SPM instruments available at MTU, and the exploration of their capabilities during assigned team projects.
Credits: 1.0
Lec-Rec-Lab: (0-0-3)
Semesters Offered: On Demand - Offered alternate years beginning with the 2011-2012 academic year
Restrictions: Permission of instructor required; May not be enrolled in one of the following Class(es): Freshman

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 4740 - Hydrometallurgy/Pyrometallurgy
Extraction and refining of metals and industrial chemicals from natural and recycled materials. Includes solution-chemistry processes (hydrometallurgy) and thermochemical processes (pyrometallurgy).
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): CH 1122 or (CH 1160 and CH 1161)

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 4920 - Materials Science & Engineering Senior Design Project I
Conducted in teams of students working with industrial partners. 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
Pre-Requisite(s): MY 3110 and MY 3200 and MY 3210 and MY 3300 and MY 4940(C)

MY 4930 - Materials Science & Engineering Senior Design Project II
Senior design project conducted in teams of students working with an industrial partner. Open to all engineering majors interested in interdisciplinary senior design projects. Senior project ready as defined by major substitutes for prerequisites.
Credits: 2.0
Lec-Rec-Lab: (0-0-6)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior
Pre-Requisite(s): MY 4920

MY 4940 - Materials Science and Engineering Design of Experiments
Six Sigma strategy to solving materials engineering problems, including: Define-Measure-Analyze-Improve- Control to reduce process variation, Design for Six Sigma tools for new process development, and the use of Minitab software in statistical engineering methods. Communication and teaming skills are also addressed.
Credits: 2.0
Lec-Rec-Lab: (0-2-0)
Semesters Offered: Spring
Pre-Requisite(s): MY 3100 and MY 3110(C) and MY 3200 and MY 3210(C) and MY 3300(C)

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

Operations & Supply Chain Mgmt

OSM 3000 - Operations and Supply Chain Management
Fundamental principles of operations and supply chain 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, and capacity management.
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): (MA 1135 or MA 1160 or MA 1161) and MA 2710 or MA 2720 or MA 3710 or MA 3720 or EET 2010 or BUS 2100 or BA 2100

OSM 3150 - Introduction to Supply Chain Management
An introduction to supply chain management to gain a perspective on integration and coordination issues. Topics include strategy, network design, facility design, sourcing, logistics, forecasting, inventory, relationship management, and global and sustainable supply chain 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): OSM 3000

OSM 3200 - 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.
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): MA 2710 or MA 2720 or MA 3710 or EET 2010 or BUS 2100 or BA 2100

OSM 3600 - Procurement and Supply Management
Addresses processes that facilitate the management of value added transactions and relationships between supplier and customer organizations. The course examines the management of the business purchasing function, including supplier selection and development, cost management, performance measures, buyer-supplier relationships, and negotiation.
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): (MA 2720 or MA 3710) and (MA 1135 or MA 1160 or MA 1161)

OSM 4100 - 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 or OSM 3000

OSM 4150 - Advanced Supply Chain Management
Advanced topics in supply chains including forecasting methods, inventory control, facility location, routing of physical flows among facilities, aggregate planning, contracts, and distribution and network design. Includes the use of spreadsheet modeling tools to solve complex supply chain problems.
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): BUS 2300 and OSM 3150
OSM 4200 - Advanced Project Management
A project oriented business development class focused on real-life and advanced applications of project management techniques. Students participate in a competition, prepare for the PMI CAPM exam, and may sit for the exam to obtain certification.
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): OSM 3200 or OSM 4300 or SSE 4300

OSM 4650 - Six Sigma Fundamentals
Course is framed in context of six sigma methodology. Topics include principles of Shewhart, Deming, and Taguchi; meaning of quality; control charts for variables, individuals, and attributes; process capability analysis; variation of assemblies; and computer-based workshops.
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): MA 2710 or MA 3710 and (MA 1135 or MA 1160 or MA 1161)

OSM 4700 - Logistics and Transportation Management
Focuses on the transportation and distribution services that support demand fulfillment from the receipt of customer orders to order fulfillment. Topics include customer service, order fulfillment, inventory, transportation costs and modes, facility design and operation, carrier selection, and negotiation.
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): MA 2710 or MA 2720 or MA 3710 or MA 3720 or BUS 2100

OSM 4950 - Internship
An internship experience in a business related field. Must have gained a minimum of 90 SHS units and must be approved by the internship coordinator.
Credits: 3.0
Lec-Rec-Lab: (0-0-0)
Semesters Offered: Spring, Fall, Winter
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): MA 3710 or OSM 3200 or OSM 4300 or SSE 4300

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PE 0117 - Beginning Hockey
Individual skills, team techniques, rules, and strategies. Requires basic hockey equipment of helmet with face mask, shoulder pads, hockey pants, shin pads, elbow pads, hockey gloves, skates, supporter, jersey, hockey socks, hockey stick. May be used once as a general education co-curricular course.
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. May be used once as a general education co-curricular course.
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 taught, evaluated, and recommendations made for improvement. Students must provide their own transportation to Mont Ripley. It is recommended that students provide their own equipment. Daily rental and “rent for the season” equipment available at Mont Ripley.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring, Summer

PE 0121 - Beginning Snowboarding
Beginning skills of snowboarding techniques taught, evaluated, and recommendations made for improvement. Students must be a beginner or have never snowboarded to this class. Students with skills above beginner level cannot take this class. Students must provide their own transportation to Mont Ripley. It is recommended that students provide their own equipment. Daily rental and “rent for the season” equipment available at Mont Ripley.
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. May be used once as a general education co-curricular course.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Spring

PE 0123 - Telemark Skiing
The beginning skills of Telemark skiing techniques will be taught, evaluated and recommendations made for improvement. Students must provide their own transportation and Telemark ski equipment. Rentals are not available.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Summer

PE 0125 - Sand Volleyball
Sand volleyball rules, basic fundamentals and team play. 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. May be used once as a general education co-curricular course.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Summer

PE 0126 - Beginning Volleyball
Fundamental skills, rules interpretation, strategy, and conduct of tournament play. May be used once as a general education co-curricular course.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring

PE 0127 - Beginning Archery
Students will demonstrate the fundamental knowledge and skills of archery, safety, and care of equipment necessary for its enjoyment and participation as a lifelong activity. One dozen arrows must be supplied by the student (available for purchase on campus). May be used once as a general education co-curricular course.
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 water exercise. May be used once as a general education co-curricular course.
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. May be used once as a general education co-curricular course.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Summer

PE 0135 - Beginning Cross Country Skiing
Develop the skills for touring/recreational cross-country skiing. Own equipment is recommended; rental equipment available. May be used once as a general education co-curricular course.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring

PE 0137 - Table Tennis
Fundamental skills of table tennis will be taught. May be used once as a general education co-curricular course.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, 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. May be used once as a general education co-curricular course.
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. May be used once as a general education co-curricular course.
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. Non-marking court shoes must be worn. Tennis balls and racquets provided. Recommend use of personal racquet. May be used once as a general education co-curricular course.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring

PE 0145 - Beginning Rifle
Using precision air rifles, beginners develop an awareness of firearms safety and marksmanship. May be used once as a general education co-curricular course.
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. May be used once as a general education co-curricular course.
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. May be used once as a general education co-curricular course.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring

PE 0150 - Outdoor Lifetime Activities
This class will introduce students to a variety of recreational activities often used in a social/leisure setting (i.e. ladder golf, disc golf, croquet, etc.). May be used once as a general education co-curricular course.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring, Summer

PE 0151 - Indoor Lifetime Activities
This class will introduce students to a variety of recreational activities often used in a social/leisure setting (i.e., shuffleboard, billiards, table tennis, etc.). May be used once as a general education co-curricular course.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring

PE 0152 - Beginning Social Dance
Introduction to a variety of dance steps, such as the jitterbug/swing, polka, country 2 step, tango, waltz, foxtrot, and slow dance. May be used once as a general education co-curricular course.
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. May be used once as a general education co-curricular course.
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. May be used once as a general education co-curricular course.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Summer

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. May be used once as a general education co-curricular course.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Summer

PE 0165 - Rowing
Students will learn the anatomy and technique of rowing. Students will be given workouts they can use outside of class to improve their technique and fitness levels. Workouts during class will vary accordingly with class ability levels.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring

PE 0166 - Moving for Fitness
Introductory course to using the Student Development Complex and surrounding outdoor facilities in a variety of group and individual activities. Basic movement at your own level. May be used once as a general education co-curricular course.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring, Summer

PE 0167 - Beginning Yoga
Learn the basics or compliment previous experience while improving flexibility, balance and concentration. Improve focus. Relax mentally and physically.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring

PE 0168 - Beginning Pilates
Students will learn a unique approach to exercise that develops body awareness. Pilates is one of the safest forms of exercise today. Students will improve coordination, posture and flexibility, as well as, release stress. May be used once as a general education co-curricular course.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring

PE 0169 - Spinning
High energy, group cycling class. No complicated moves to learn. Upbeat music that gets your legs pumping.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring

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. May be used once as a general education co-curricular course.
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; may involve hiking, camping, fishing, orienteering, etc. Class is instructed by staff of the Outdoor Adventure Program. May be used once as a general education co-curricular course.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall

PE 0174 - Winter Outdoor Adventures
Outdoor seasonal activities; may involve fishing, camping, skiing, orienteering, etc. Class is instructed by staff of the Outdoor Adventure Program. May be used once as a general education co-curricular course.
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. Appropriate clothing and footwear for hiking is recommended. Course meets on weekends (usually Saturdays). May be used once as a general education co-curricular course. Due to class structure, students must attend all classes - No Exceptions.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Summer
PE 0176 - Outdoor Adventure
Students will engage in multi-day backpacking with overnight camping. Destinations are variable, possibilities include Isle Royale National Park, Porcupine Mountains, etc. Instructors will include trained wilderness guides and class/laboratory fee will cover miscellaneous costs such as park permits, transportation costs, camping gear, and group meals.
Credits: variable to 3.0; Repeatable to a Max of 3; Graded Pass/Fail Only
Semesters Offered: Summer

PE 0200 - Fitness Foundations
Students will be introduced to practices and physical activities that they can incorporate into their daily life to sustain their healthy body and mind.
Credits: 1.0; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring

PE 0205 - Intermediate Bowling
Intermediate to advanced techniques in bowling, including skills and strategy involved in tournament play, May be used once as a general education co-curricular course.
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. Each topic may count once as a general education co-curricular course as long as the topic and course content are different than other co-curricular courses taken.
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. May be used once as a general education co-curricular course.
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. May be used once as a general education co-curricular course.
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. Requires basic hockey equipment of helmet with face mask, shoulder pads, hockey pants, shin pads, elbow pads, hockey gloves, skates, supporter, jersey, hockey socks, hockey stick. May be used once as a general education co-curricular course.
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. May be used once as a general education co-curricular course.
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 techniques taught, evaluated and recommendations made for improvement. Students must provide their own transportation to Mont Ripley. It is recommended that students provide their own equipment. Daily rental and "rent for the season" equipment available at Mont Ripley. May be used once as a general education co-curricular course.
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 techniques taught, evaluated, and recommendations made for improvement. Students must provide their own transportation to Mont Ripley. It is recommended that students provide their own equipment. Daily rental and "rent for the season" equipment available at Mont Ripley. May be used once as a general education co-curricular course.
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 techniques taught. Ski races each week, alternating between giant slalom, slalom, and super G. Students must provide their own transportation to Mont Ripley. It is recommended that students provide their own equipment. Daily rental and "rent for the season" equipment available at Mont Ripley. May be used once as a general education co-curricular course.
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 (jumps/tricks) skiing techniques taught, evaluated, and recommendations made for improvement. Students must provide their own transportation to Mont Ripley. It is recommended that students provide their own equipment. Daily rental and "rent for the season" equipment available at Mont Ripley. May be used once as a general education co-curricular course.
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 techniques taught. Weekly bordercross racing. Students must provide their own transportation to Mont Ripley. It is recommended that students provide their own equipment. Daily rental and "rent for the season" equipment available at Mont Ripley. May be used once as a general education co-curricular course.
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 (jumps/tricks) snowboarding techniques taught, evaluated, and recommendations made for improvement. Students must provide their own transportation to Mont Ripley. It is recommended that students provide their own equipment. Daily rental and "rent for the season" equipment available at Mont Ripley. May be used once as a general education co-curricular course.
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. May be used once as a general education co-curricular course.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring
PE 0227 - Intermediate Archery
Students will improve their fundamental knowledge and skills of archery leading to continued enjoyment and participation as a lifelong activity. Students must have their own bow. One dozen arrows must be supplied by the student (available for purchase on campus). May be used once as a general education co-curricular course.
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. May be used once as a general education co-curricular course.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring

PE 0232 - Intermediate Soccer
Intermediate to advanced techniques, skills, and strategies involved in soccer. May be used once as a general education co-curricular course.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring, Summer

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. May be used once as a general education co-curricular course.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring, Summer

PE 0237 - Intermediate Table Tennis
Intermediate/advanced skills of table tennis will be taught. May be used once as a general education co-curricular course.
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. May be used once as a general education co-curricular course.
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. May be used once as a general education co-curricular course.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring

PE 0240 - Intermediate Tennis
Intermediate to advanced techniques, skills, and strategies in tennis. Class meets at Gates Tennis Center. Non-marking court shoes must be worn. Tennis balls and racquets provided. Recommend use of personal racquet. May be used once as a general education co-curricular course.
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. May be used once as a general education co-curricular course.
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. May be used once as a general education co-curricular course.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring

PE 0250 - Intermediate Social Dance
Continuation of beginning social dance. May be used once as a general education co-curricular course.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring

PE 0253 - Intermediate Aerobics
Intermediate to advanced techniques and steps involved in aerobics. Requires previous aerobics experience. May be used once as a general education co-curricular course.
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. May be used once as a general education co-curricular course.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring, 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. May be used once as a general education co-curricular course.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring, Summer

PE 0267 - Intermediate Yoga
Combined ancient Hatha yoga poses with modern fitness movement to create a total mind/body workout for all fitness levels. Improve breathing and oxygen intake.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring

PE 0268 - Intermediate Pilates
Students will learn advanced techniques to build strength and flexibility while engaging the muscles of their abdominals, lower back and hips, otherwise known as the "Power House" for a more streamline shape.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring

PE 0270 - Intermediate Tae Kwon Do and Hapkido
Intermediate to advanced techniques, skills, and strategies involved in TaeKwonDo. May be used once as a general education co-curricular course.
Credits: 0.5; 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. May be used once as a general education co-curricular course.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Summer
PE 0315 - Fitness Swimming
Practices the basic strokes; introduces knowledge in creating workouts to encourage swimming as a lifetime fitness activity. May be used once as a general education co-curricular course.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring

PE 0320 - Advanced Skiing
Advanced skills of skiing techniques taught, evaluated, and recommendations made for improvement. Students must provide their own transportation to Mont Ripley. It is recommended that students provide their own equipment. Daily rental and "rent for the season" equipment available at Mont Ripley. May be used once as a general education co-curricular course.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Spring

PE 0321 - Advanced Snowboarding
Advanced skills of snowboarding techniques taught, evaluated, and recommendations made for improvement. Students must provide their own transportation to Mont Ripley. It is recommended that students provide their own equipment. Daily rental and "rent for the season" equipment available at Mont Ripley. May be used once as a general education co-curricular course.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Spring

PE 0330 - Club Sports
Club sport participation based on student interest. Group must be on the approved list of sports and all membership requirements must be up to date. Students enrolling in this course must participate in 14 hours of activity during the semester. Participation is tracked by instructor of record. No retroactive credit will be awarded for involvement in club sport activity.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring
Restrictions: Permission of instructor required

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. Non-marking court shoes must be worn. May be used once as a general education co-curricular course.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring
Pre-Requisite(s): PE 0240

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. May be used once as a general education co-curricular course.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Summer

PE 0406 - Indoor Golf
Fundamentals skills of golf will be taught. May be used once as a general education co-curricular course.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring

PE 0420 - Ski Instructor Training
Students will learn how to teach ski classes. Upon completion of this course students will have the knowledge to complete the Level I certification test with the American Snowsports Education Association, if they choose.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Spring

PE 0421 - Snowboard Instructor Training
Students will learn to teach snowboard classes. Upon completion of this course students will have the knowledge to complete the Level I certification test with the American Snowsports Education Association, if they choose.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: On Demand

PE 0425 - Intramurals
Intramural activity that addresses varying and changing student interests. Sports vary. Students must be a member of IMleagues.com/MTU.
Students enrolling in the course must participate in 14 games/contests during the portion of the semester that the course is offered to receive a passing grade. Participation is tracked via IMleagues.com/MTU. No retroactive credit will be awarded for involvement in intramural activities.
Credits: 0.5; Repeatable to a Max of 1; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring

PE 0430 - Club Sports Leadership
Leadership in club sport participation based on student interests. Students enrolling in this course must hold a position of leadership within the club sport. Group must be on approved list of sports and all membership requirements up to date. Students must participate in 14 hours of leadership activity during the semester. Participation is tracked by instructor of record. No retroactive credit will be awarded for involvement in club sport activity.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring
Restrictions: Permission of instructor required

PE 0435 - Rape Aggression Defense-Basic Physical Defense
The Rape Aggression Defense System is a program of realistic, self-defense tactics and techniques. The R.A.D. System is a comprehensive course for women that begins with awareness, prevention, risk reduction and avoidance, while progressing on to the basics of hands-on defense training. R.A.D. is not a martial arts program.
Credits: 1.0; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Spring
Restrictions: Permission of department required

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 general education co-curricular activity.
Credits: 1.0; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Spring

PE 1580 - Water Safety Skills
American Red Cross swimming and diving skills required for certification in Water Safety Instructor. Fulfills 1 unit of general education co-curricular activity.
Credits: 1.0; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Spring
Co-Requisite(s): EH 2580

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PE 1690 - Medical 1st Responder Training
Students will be trained on how to deal with medical emergencies. The physically active hands-on training includes a wide variety of medical skills and equipment such as airway control, backboards, spinal immobilization, oxygen therapy, patient assessment and splinting.
Credits: 1.0; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Fall, Summer
Co-Requisite(s): EH 3690

PE 2010 - Varsity Football
Selective collegiate-level sports participation requiring an elite level of skill and extensive time commitment. May be used once as a general education co-curricular course.
Credits: 1.0; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-5)
Semesters Offered: Fall, Spring
Restrictions: Permission of department required

PE 2130 - Varsity Volleyball
Selective collegiate-level sports participation requiring an elite level of skill and extensive time commitment. May be used once as a general education co-curricular course.
Credits: 1.0; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-5)
Semesters Offered: Fall
Restrictions: Permission of department required

PE 2140 - Varsity Cross Country
Selective collegiate-level sports participation requiring an elite level of skill and extensive time commitment. May be used once as a general education co-curricular course.
Credits: 1.0; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-5)
Semesters Offered: Fall, Spring
Restrictions: Permission of department required

PE 2150 - Cross Training
A broad base understanding of sports cross training and activities that can be pursued as lifelong activities. May be used once as a general education co-curricular course.
Credits: 1.0; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-5)
Semesters Offered: Fall, Spring
Restrictions: Permission of department required

PE 2020 - Varsity Basketball
Selective collegiate-level sports participation requiring an elite level of skill and extensive time commitment. May be used once as a general education co-curricular course.
Credits: 1.0; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-5)
Semesters Offered: Fall, Spring
Restrictions: Permission of department required

PE 2040 - Varsity Nordic Skiing
Selective collegiate-level sports participation requiring an elite level of skill and extensive time commitment. May be used once as a general education co-curricular course.
Credits: 1.0; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-5)
Semesters Offered: Spring
Restrictions: Permission of department required

PE 2050 - Varsity Soccer
Selective collegiate-level sports participation requiring an elite level of skill and extensive time commitment. May be used once as a general education co-curricular course.
Credits: 1.0; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-5)
Semesters Offered: Fall, Spring
Restrictions: Permission of department required

PE 2080 - Varsity Track
Selective collegiate-level sports participation requiring an elite level of skill and extensive time commitment. May be used once as a general education co-curricular course.
Credits: 1.0; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-5)
Semesters Offered: Spring
Restrictions: Permission of department required

PE 2090 - Varsity Tennis
Selective collegiate-level sports participation requiring an elite level of skill and extensive time commitment. May be used once as a general education co-curricular course.
Credits: 1.0; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-5)
Semesters Offered: Fall, Spring
Restrictions: Permission of department 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. Course is also offered online on demand in spring and summer semesters.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring, Summer
Pre-Requisite(s): MA 1031(C) or MA 1032(C)

PH 1091 - The Physics Behind Music Lab
A companion hands-on lab course covering topics from PH1090.
Credits: 1.0
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall
Pre-Requisite(s): PH 1090(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)
Semesters Offered: Fall, Spring, Summer
Pre-Requisite(s): MA 1160(C) or MA 1161(C)
PH 1110 - College Physics I
An overview of basic principles of kinematics, dynamics, elasticity, fluids, heat, thermodynamics, mechanical waves, and interference and diffraction of mechanical waves.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Summer
Restrictions: May not be enrolled in one of the following College(s): School of Technology, College of Engineering; May not be enrolled in one of the following Major(s): Physics, Applied Physics
Co-Requisite(s): PH 1111
Pre-Requisite(s): MA 1031 or MA 1032 or MA 1135(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, Summer
Restrictions: May not be enrolled in one of the following College(s): School of Technology, College of Engineering; May not be enrolled in one of the following Major(s): Physics, Applied Physics
Co-Requisite(s): PH 1110

PH 1140 - Applied College Physics I
An algebra-based introduction to classical mechanics and its applications. Topics include kinematics, Newton's laws, impulse and momentum, work and energy, simple harmonic motion, mechanical waves and sound, and temperature and heat.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Major(s): Engineering Technology, Mechanical Engineering Tech, Computer Network & System Admin, Electrical Eng Tech (BS), Theatre & Entertainment Tech (BS), Construction Management
Co-Requisite(s): PH 1141
Pre-Requisite(s): MA 1031 or MA 1032 or MA 1160(C) or MA 1161(C)

PH 1141 - Applied 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 PH1140.
Credits: 1.0
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Major(s): Engineering Technology, Mechanical Engineering Tech, Computer Network & System Admin, Electrical Eng Tech (BS), Theatre & Entertainment Tech (BS), Construction Management
Co-Requisite(s): PH 1140

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, research within the department, and professional opportunities in physics. Intended for physics majors; highly motivated students seeking an invigorating introduction to physics may enroll with permission of the instructor.
Credits: 4.0
Lec-Rec-Lab: (4-0-0)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Major(s): Physics, Physics, Applied Physics
Co-Requisite(s): PH 1161
Pre-Requisite(s): 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
Restrictions: Must be enrolled in one of the following Major(s): Physics, Physics, Applied Physics
Co-Requisite(s): PH 1160

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 1141 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, Summer
Restrictions: May not be enrolled in one of the following College(s): School of Technology, College of Engineering; May not be enrolled in one of the following Major(s): Physics, Applied Physics
Pre-Requisite(s): PH 1200(C) and PH 1110

PH 1240 - Applied College Physics II
An overview of static and dynamic electricity and magnetism, electromagnetic waves, basic optics, and an introduction to modern and nuclear physics with an emphasis on problem solving and applications.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following College(s): School of Technology, College of Engineering; May not be enrolled in one of the following Major(s): Physics, Applied 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 2160(C)

PH 1361 - Introductory Experimental Physics II
Laboratory complement to PH 1360. 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: 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, Summer

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-Req (s): PH 1600

PH 2020 - Introduction to Error Analysis and Scientific Programming
An introduction to error analysis and scientific programming. Students will develop the skills needed to reduce and analyze data acquired in upper level physics labs (e.g. PH3480). Examples include error propagation and computer aided curve fitting.

Credits: 1.0
Lec-Rec-Lab: (1-0-0)
Semesters Offered: Fall
Pre-Requisite(s): PH 1100 or PH 2100

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 1160 or MA 1161 or MA 1135 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(C))

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): Electrical Engineering, Computer 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 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 2260

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 spring 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: Fall, Spring, Summer
Pre-Requisite(s): PH 2200 or PH 2260

PH 3110 - Theoretical Mechanics I
An intermediate study of mechanics, including the study of Newtonian mechanics of a single particle and multiple-particle systems, oscillations, motion in noninertial reference frames, gravitation and central-force motion, and Lagrangian mechanics.

Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Pre-Requisite(s): (PH 2200 or PH 2260) 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 rigid body motion, relativistic mechanics, and coupled oscillations. Additional topics may include chaos theory, Hamiltonian mechanics, 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 3160 and (MA 3520 or MA 3521 or MA 3530 or MA 3560)

PH 3410 - Quantum Physics I
An introduction to the foundations of modern physics and Schrödinger's wave mechanics. Topics include thermal radiation, particle-like properties of radiation, Bohr's model of the atom, matter waves, Schrödinger's wave mechanics, quantization of angular momentum, and the one-electron atom.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: 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 - Advanced Physics Laboratory
Through a series of experiments, students investigate physical phenomena that underlie modern physics. In the process, students become familiar with experimental techniques and instrumentation used in modern research laboratories.
Credits: 2.0
Lec-Rec-Lab: (0-0-6)
Semesters Offered: Spring
Pre-Requisite(s): PH 2230 and PH 3210

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. Serves as an excellent preparation for students taking the GRE Subject Test in physics.
Credits: 1.0: Graded Pass/Fail Only
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Major(s): Physics, Applied 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 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 2020 and PH 3410

PH 4395 - Introduction to 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: On Demand
Pre-Requisite(s): PH 3300 and PH 4390 and (PH 2400 or PH 3410)

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 1150 and CH 1151) 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. Course offered every third year beginning 2008-09.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2008-2009 academic year
Pre-Requisite(s): PH 1600 and PH 2400 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. Course offered every third year beginning 2009-10.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2009-2010 academic year
Pre-Requisite(s): PH 1600 and PH 2400 and (MA 3520 or MA 3521 or MA 3530 or MA 3560)

PH 4630 - Particle Astrophysics
Introduction to the twin fields of elementary particle physics and high energy astrophysics. Topics include an overview of particles and interactions, the expanding universe, conservation laws, dark matter and dark energy, large scale structure, and cosmic particles. Course offered every third year beginning 2007-08.
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): PH 2400 and (MA 3520 or MA 3521 or MA 3530 or MA 3560)

PH 4640 - Introduction to Atmospheric Physics
Essential elements of atmospheric physics, including thermodynamics (adiabatic processes, phase transformations, stratification), aerosol and cloud physics (e.g. nucleation, Kohler theory, growth by condensation and collection), radiative transfer (e.g. Beer's law, transfer equations with and without scattering).
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall - Offered alternate years beginning with the 2013-2014 academic year
Pre-Requisite(s): (PH 2200 or PH 2260) and (PH 1360 or PH 2300) and MA 3160 and (MA 3520 or MA 3521 or MA 3530 or MA 3560)

PH 4710 - Methods of Teaching Physics
Hands-on exploration of physics education methods in classroom, laboratory, and tutoring environments. Students study highlights of physics education research and explore use of several tools and pedagogical techniques, including web-based homework systems, simulations, classroom feedback systems, and equipment for laboratories and lecture demonstrations.
Credits: 2.0
Lec-Rec-Lab: (0-1-2)
Semesters Offered: Spring - Offered alternate years beginning with the 2010-2011 academic year
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): PH 1210 or PH 2200 or PH 2260

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

Psychology

PSY 2000 - Introduction to 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
Pre-Requisite(s): PSY 2000

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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
Pre-Requisite(s): PSY 2000

PSY 2300 - 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 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

PSY 2400 - Health Psychology
Examines the theoretical, empirical, and historical bases for health psychology. Topics may include the effects of stress, determinants of addictive behavior, the impact of psychological factors on physical health, obesity, and the causes and treatment of chronic pain.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2012-2013 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: On Demand
Restrictions: Must be enrolled in one of the following Major(s): Psychology
Pre-Requisite(s): PSY 2000(C)

PSY 2600 - Psychology of Death and Dying
An examination of theory, research, and issues in the psychology of death and dying. Topics may include the development of death concepts, death anxiety in society, the needs of the dying person, the psychology of grieving, and unexpected losses.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Summer
Pre-Requisite(s): PSY 2000

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: (0-3-1)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Major(s): Social Sciences, Psychology
Pre-Requisite(s): MA 1020 or MA 1031 or MA 1032 or MA 1160(C) or MA 1161(C)

PSY 3000 - Experimental Methods & Stats
Introduction to experimental design, general research methodology, 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, statistical analysis, and APA writing style.
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, Sophomore
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: Spring
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, Summer
Pre-Requisite(s): PSY 2000

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 Social-cultural 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
Pre-Requisite(s): PSY 2000

PSY 3040 - History and Systems of Psychology
Traces major historical contributions to current psychology from ancient to modern times. Examines significant ideas and discoveries from philosophy, mathematics, 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: Spring
Pre-Requisite(s): PSY 2000

PSY 3060 - Physiological Psychology
Study of the relations between psychological manipulations and resulting physiological responses to promote understanding of mind/body interaction. Will examine psychophysiological measurement methods, research, and the application of psychophysiology.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): PSY 2000 and (BL 1020 or BL 1040 or BL 2010)
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: Fall - Offered alternate years beginning with the 2012-2013 academic year
Pre-Requisite(s): PSY 2000

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 3100 - Application of Treatment Models
An applied review of psychological treatment models, including their history, their strengths and weaknesses, and the fundamental concepts that support each model. Students will be required to apply one of the models in a direct practice format.

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 PSY 2100

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 3250 - Persuasion and Attitude Change
Human beings develop attitudes as a result of experience. Attitudes shape future behavior and impact perception. This course will explore how attitudes are identified, categorized and measured, and will examine many of the variables associated with changing established attitudes.

Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: On Demand
Pre-Requisite(s): PSY 2000

PSY 3700 - 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 2012-2013 academic year
Restrictions: May not be enrolled in one of the following Class(es):
Freshman
Pre-Requisite(s): PSY 2000

PSY 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: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): UN 2002 or PSY 2000

PSY 3750 - Judgment and Decision Making
How can we make better decisions? Using examples from medicine, politics, law, business, and daily life, we review "descriptive" (psychological), "normative" (rational), and "prescriptive" (decision-engineering) theory. Topics include judgment, cognition, emotion, risk, uncertainty, optimization, heuristics, biases, morality, and applications.

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): PSY 2720 or MA 2720

PSY 3800 - Environmental Psychology
Psychological effects of the physical environment and effects of human action on the sociophysical environment, including an examination of global environmental issues and ecologically-relevant behavior.

Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall - Offered alternate years beginning with the 2014-2015 academic year
Restrictions: May not be enrolled in one of the following Class(es):
Freshman
Pre-Requisite(s): PSY 2000

PSY 3850 - 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
Restrictions: May not be enrolled in one of the following Class(es):
Freshman
Pre-Requisite(s): PSY 2000

PSY 3860 - Human Performance
An overview of cognitive task analysis and process tracing methods used to examine human performance in complex socio-technical systems. Topics include knowledge elicitation, concept mapping, critical decision method, and protocol analysis.

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): 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, Summer
Restrictions: May not be enrolled in one of the following Class(es):
Freshman
Pre-Requisite(s): PSY 2000

PSY 4060 - Cognitive Neuroscience
Topics in the field of cognitive neuroscience, examining the neural basis of cognition. Topics may include perception, attention, memory and language.
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): PSY 3060

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

PSY 4090 - Independent Study in Psychology
Designed to allow students to participate in independent readings or research in a variety of areas within psychology.
Credits: variable to 6.0; Repeatable to a Max of 9
Semesters Offered: On Demand
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

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

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: Fall
Restrictions: May not be enrolled in one of the following Class(es):
Freshman
Pre-Requisite(s): PSY 2000

PSY 4160 - Sensation and Perception
Examination of basic sensory mechanisms and perceptual phenomena. Sensory mechanisms reviewed will include vision, audition, olfaction, gustation, vestibular system and touch.
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): PSY 2000 and (BL 1040 or BL 1020)

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: On Demand
Restrictions: May not be enrolled in one of the following Class(es):
Freshman
Pre-Requisite(s): PSY 2000

PSY 4400 - Tests and Measurements
Review of psychological tests and test theory, along with principles of construction and analysis of psychological tests.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
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 2720 or MA 2720

PSY 4500 - Senior Seminar: Psychology Capstone
Focusing on application to graduate programs, an intensive exploration into an area (e.g., experimental, developmental, clinical) of psychology or related field, will enhance learning and synthesize career goals in an effort to transition to an advanced educational program.
Credits: 1.0
Lec-Rec-Lab: (0-1-0)
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, Junior
Pre-Requisite(s): PSY 3000(C)

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

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SAT 1200 - Introduction to Programming
Introductory course in C/C++ programming. Topics include top-down analysis of problems, structured programming, control statements, loops, and functions, arrays, and pointers. Basic concepts of object-oriented programming (classes, objects, function overloading) will also be introduced.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Major(s): Industrial Technology, Computer Network & System Admin; Must be enrolled in one of the following Class(es): Freshman, Sophomore

SAT 1610 - Computer and Operating Systems Architecture
Fundamentals of computer organization, operating system architecture, PC/WS major subassemblies, PC and server configuration planning, power interfaces, system assembly/setup, connection of peripherals, installing fundamental operating system software, system testing/debugging and planning and installation of application software portfolios.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Major(s): Computer Network & System Admin, Audio Production & Technology
Pre-Requisite(s): SAT 1200

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, and standards development bodies.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
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, 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, Summer
Pre-Requisite(s): SAT 1610

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

SAT 2711 - Unix & Linux Administration I
Study of networked systems in Unix and Linux. Topics include Linux file system administration, Bash shell, system initialization and X windows, Linux processes management, print and log administration, compression, system backup/restore, network services (FTP, NFS, Samba), and security (firewall) configuration.
Credits: 4.0
Lec-Rec-Lab: (0-3-3)
Semesters Offered: Fall
Pre-Requisite(s): SAT 1200

SAT 3200 - Storage Area Networking
Study of distributed network storage methods, that include ISCSI, DAS, NAS, and SAN technologies. Other topics include storage and computer virtualization, configuration management, storage farms, backup and recovery.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Fall, Spring
Pre-Requisite(s): SAT 2511 and SAT 2711

SAT 3210 - Database Management
Introductory course on database management. Topics include data modeling, database design, implementation techniques, Oracle SQL Language, database administration and security.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Fall, Summer
Restrictions: Must be enrolled in one of the following Major(s): Computer Network & System Admin
Pre-Requisite(s): SAT 2511 and SAT 2711

SAT 3343 - Network Administration II
Study of network devices in various architectures. Topics include routing protocols, TCP/IP, access-lists, remote network structures, network topologies, telnet and SSH authentication, switch programming, VLAN and STP configuration, IP traffic control, network troubleshooting and WAN encapsulation.
Credits: 4.0
Lec-Rec-Lab: (0-3-2)
Semesters Offered: Spring
Pre-Requisite(s): SAT 2343

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 servers, MS system tuning, remote access, and backup and recovery from failures.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Fall, Summer
Pre-Requisite(s): 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: (0-2-2)
Semesters Offered: Spring
Pre-Requisite(s): SAT 2511

SAT 3812 - Network Security Engineering I
Planning and managing system security in a TCP/IP converged enterprise network environment. Topics include security architecture, attack methods and counter-measures, 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: Fall
Pre-Requisite(s): SAT 2511 and SAT 2711
SAT 3820 - Mobile Computing and FCC Regulations
Evolution of wireless communications, standards, and regulations. Topics include IEEE 802.11b/a/g Physical & MAC Layer Standards, Site Survey, WLAN Security and Vulnerabilities, Troubleshooting, Personal, Metropolitan, and Wide Area Wireless Networks (Bluetooth, WiMax, Cellular & Satellite Networks).
Credits: 4.0
Lec-Rec-Lab: (0-3-2)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Major(s): Computer Network & System Admin
Pre-Requisite(s): SAT 3812

SAT 3900 - New Technologies Seminar
Offered first half of semester, to be taken concurrently with SAT3901. Weekly seminar series in which speakers from industry, universities, and government discuss current developments in networking and computer technology. The emphasis is on open research topics and questions that may lead to collaborative work with faculty and graduate students.
Credits: 1.0; Repeatable to a Max of 6; Graded Pass/Fail Only
Lec-Rec-Lab: (0-2-0)
Semesters Offered: Fall
Co-Requisite(s): SAT 3901

SAT 3901 - Becoming Human - Communication and Technical Improv Seminar
Offered second half of semester, to be taken concurrently with SAT3900. Weekly seminar series aimed at developing leadership qualities, soft skills, public speaking, and reactionary skills for students in technical fields. A fun and safe environment to develop and improve communication skills through situation and scenario-based exercises that include team building and games.
Credits: 1.0; Graded Pass/Fail Only
Lec-Rec-Lab: (0-2-0)
Semesters Offered: Fall
Co-Requisite(s): SAT 3900

SAT 4240 - Voice over IP Engineering
Voice over IP (VoIP) engineering and design. Topics include call and session protocols such as SIP, H.323, IAX and MGCP; VAD and PLC; common practical issues such as call redirection; codec integration and quality of service measurements.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Spring - Offered alternate years beginning with the 2011-2012 academic year
Restrictions: Must be enrolled in one of the following Major(s): Computer Network & System Admin
Pre-Requisite(s): SAT 2511 and SAT 2711 and SAT 3343

SAT 4310 - Advanced Scripting Programming
Emphasizes advanced portions of scripting programming, testing, implementation and documentation (i.e. PERL, PHP, Python and 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: (0-2-2)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Major(s): Computer Network & System Admin
Pre-Requisite(s): SAT 1200 and 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 advanced routing protocols.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Spring - Offered alternate years beginning with the 2010-2011 academic year
Pre-Requisite(s): 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; Must be enrolled in one of the following Class(es): Junior, Senior

SAT 4541 - Directory Services Architecture
Advanced concepts of planning and implementing enterprise services including LDAP directory service, Microsoft Active Directory and Kerberos in an enterprise environment. The course covers the concept of sustainability, green computing and best practices in industry.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Fall
Pre-Requisite(s): SAT 3511(C) and SAT 3711

SAT 4600 - Web Applications and Server Administration
In-depth study of Apache web server, Microsoft Internet Information Server (IIS) and email services. Topics include server configuration, load balancing, connecting to the Internet, web security and administration, communication media, HTTP, fault tolerance, and proxy servers.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Spring
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

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: 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; Must be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): SAT 4480

SAT 4996 - Special Topics in Computer Network Systems Administration
Selected additional topics of interest in Computer Network Systems Administration based on student and faculty demand and interest. May be a tutorial, seminar, workshop, project, or class study.
Credits: variable to 3.0; Repeatable to a Max of 6
Semesters Offered: On Demand
Restrictions: Permission of instructor required; 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

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SAT 4997 - Independent Study in Computer Network Systems Administration
Independent study of an approved topic under the guidance of a Computer Network Systems Administration faculty member. May be either an academic, design, or research problem/project.
Credits: variable to 3.0; Repeatable to a Max of 6
Semesters Offered: On Demand
Restrictions: Must be enrolled in one of the following Major(s): Computer Network & System Admn; Must be enrolled in one of the following Class(es): Senior

SAT 4998 - Undergraduate Research in Computer Network Systems Administration
An undergraduate research experience in Computer Network Systems Administration. Under the guidance of a CNSA faculty member, students work on a selected/approved research problem or work directly with faculty on active research projects/grants. May require more than one semester to complete.
Credits: variable to 6.0; Repeatable to a Max of 6
Semesters Offered: On Demand
Restrictions: Permission of instructor required; Must be enrolled in one of the following Major(s): Computer Network & System Admn; Must be enrolled in one of the following Class(es): Senior

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, Anthropology

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, Spring, Summer

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, Spring, Summer

SS 2400 - Introduction to Human Geography
This course introduces students to concepts, problems, and case studies that make up the study of human geography: the spatial differentiation and organization of human activity, environmental sustainability, and the role of space and place in our everyday lives.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Summer

SS 2500 - United States History to 1877
This broad historical survey will examine the social, political, and economic development of North America and the US from initial human settlement through the civil war.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Summer - Offered alternate years beginning with the 2014-2015 academic year

SS 2501 - United States History Since 1877
This broad historical survey will examine important intellectual, political, and social changes and events in the United States over the course of the twentieth century and beyond, representing the perspective of a wide variety of diverse individuals and groups.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall - Offered alternate years beginning with the 2013-2014 academic year

SS 2502 - European History to 1650
A survey of the history of Europe from the Archaic Greek period to 1650. Covers political, social, intellectual, religious, economic, and artistic developments of the European continent.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall - Offered alternate years beginning with the 2012-2013 academic year

SS 2503 - European History Since 1650
A survey of the history of Europe from the mid-seventeenth century to the present. Covers political, social, intellectual, religious, economic, and artistic developments on the European continent.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2013-2014 academic year

SS 2504 - World History to 1500
An introduction to the basic themes and content of world history from antiquity to 1500 CE.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2012-2013 academic year

SS 2505 - World History Since 1500
Survey of world history from 1500 CE to the present. Traces the evolution of different societies from around the world, emphasizing exchanges, interactions, and conflicts that produced global change.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2013-2014 academic year

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

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: Fall, Spring, Summer - Offered alternate years beginning with the 2006-2007 academic year
SS 2635 - Comparative Politics
Study of the government and politics of non-U.S. countries. Covers parliamentary, authoritarian, and presidential systems. Some attention to politics of the European Union.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring

SS 2700 - Introduction to Sociology
Introduces students to the way that sociologists think about different components of society. Topics include the family, religion, markets, organizations, political systems, and educational systems. Also covers the source of individual values, beliefs, and attitudes.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Summer

SS 3110 - Food Systems
Compares the embedded nature of culturally defined food production and consumption habits: the crux of nature meeting and mixing with culture. The course features classic food system scholarship as well as emerging topics and contemporary case studies.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall - Offered alternate years beginning with the 2012-2013 academic year

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: Fall - Offered alternate years beginning with the 2008-2009 academic year
Restrictions: May not be enrolled in one of the following Class(es): Freshman

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

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

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): SS 2200

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, Summer - Offered alternate years beginning with the 2007-2008 academic year

SS 3250 - Human Origins & Evolution
A human evolution course focusing upon a summary of general bio-anthropological principles of evolutionary change, the current fossil record evidencing human evolution, and the consequences of human evolutionary change for modern human variability, health, and behavior.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall - 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 1002 or UN 1003 or SS 2100

SS 3260 - Latin American Cultural History
This course examines the diverse, but interconnected, cultures of Latin America. The class will examine the sources and patterns of particular cultural traditions, while at the same time understanding the trajectory of social, political, and economic transformations throughout the region.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2009-2010 academic year
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): UN 1025 or UN 1002 or UN 1003

SS 3270 - Archaeology of the African Diaspora
Forced into slavery, the 'scatterlings' of Africa adapted and struggled to thrive in the New World. Archaeologists studying the Diaspora generally examine: ethogenesis and blending of identity, migration, structural inequalities, and the construction of race and racism.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2009-2010 academic year

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: Fall, Spring, Summer

SS 3313 - Sustainability Science, Policy, and Assessment
Foundational scientific concepts (dynamic systems and catastrophe theory) as applied to socioecological systems. Use of indicators and indices to track progress towards sustainability goals. Review of local, national, and global sustainability policies to avoid catastrophes and guide sustainable development.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2012-2013 academic year

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SS 3315 - Population and Environment
This course investigates relationships between the world's population, population change, population distribution, resource consumption, and environmental and social consequences. Addresses local and global relationships and the population processes (mortality, fertility, and migration) involved.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2012-2013 academic year
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): (MA 1030 and MA 1031) or MA 1032

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, Spring, Summer - Offered alternate years beginning with the 2002-2003 academic year

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, Spring, Summer - Offered alternate years beginning with the 2010-2011 academic year

SS 3500 - Modern American History
Surveys American history since 1945 using popular literature and film as a window onto social, economic, and political change.
Credits: 3.0
Lec-Rec-Lab: (2-0-3)
Semesters Offered: Spring, Summer

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: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman

SS 3510 - History of American Technology
Survey of the technological changes that transformed a rural, agrarian America into an urban, industrialized nation. Focuses on how America's social values and geographical situation influenced the direction taken by its technology and engineering community and how America's industrialization, in turn, had significant effects on American society.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2006-2007 academic year
Restrictions: May not be enrolled in one of the following Class(es): Freshman

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
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): UN 1015 or UN 2001

SS 3512 - Building America: The History of Planning, Engineering, and Development in the United States
This course surveys the landscapes and environments that Americans have designed, built, and inhabited. Students will consider how places both reflect and shape ideas, policy, technologies, and social relationships.
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

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: Fall

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
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): UN 1015 or UN 2001

SS 3521 - Energy in American History
Examines changes in energy use throughout American history, beginning with energy use by American Indians and Europeans during colonial settlement and continuing through fossil fuels and adoption of nuclear power. Helps students see energy in all we do.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2013-2014 academic year

SS 3530 - The Automobile in America
Examines the automobile in diverse ways, seeing it as a complex product to be manufactured, as a stimulus to reshaping the environment, as an object that has altered social behavior, and as a problem solver and problem maker.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
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 2013-2014 academic year
Restrictions: May not be enrolled in one of the following Class(es): Freshman

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: On Demand

SS 3552 - Renaissance & Reformation
The history of Europe from 1300 to 1650.
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

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

SS 3561 - History of England II
History of England from 1714 to the present, including political, social, and economic developments in the period of Britain’s greatest influence in the world.
Credits: 3.0
Lec-Rec-Lab: (3-0-0) 
Semesters Offered: Spring, Summer
Restrictions: May not be enrolled in one of the following Class(es): Freshman

SS 3562 - History of America
History of the United States from 1492 to present.
Credits: 3.0
Lec-Rec-Lab: (3-0-0) 
Semesters Offered: Fall - Offered alternate years beginning with the 2011-2012 academic year
Restrictions: May not be enrolled in one of the following Class(es): Freshman

SS 3563 - History of Michigan and the Midwest
The history of Michigan and the Midwest, from prehistoric times to the present.
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

SS 3564 - History of the World
The history of the world from prehistoric times to the present.
Credits: 3.0
Lec-Rec-Lab: (3-0-0) 
Semesters Offered: Fall - Offered alternate years beginning with the 2013-2014 academic year
Restrictions: May not be enrolled in one of the following Class(es): Freshman

SS 3565 - History of the Americas
The history of the Americas from prehistoric times to the present.
Credits: 3.0
Lec-Rec-Lab: (3-0-0) 
Semesters Offered: Fall - Offered alternate years beginning with the 2013-2014 academic year
Restrictions: May not be enrolled in one of the following Class(es): Freshman

SS 3566 - History of the World
The history of the world from prehistoric times to the present.
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

SS 3570 - History of Canada
Political, social, economic, and cultural development of Canada from earliest European settlement to the present.
Credits: 3.0
Lec-Rec-Lab: (3-0-0) 
Semesters Offered: On Demand
Restrictions: May not be enrolled in one of the following Class(es): Freshman

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 2013-2014 academic year
Restrictions: May not be enrolled in one of the following Class(es): Freshman

SS 3581 - History of Science
A survey of the development of scientific ideas (abstractions about how nature is and behaves) from the Greeks to the modern world, including major physical and life science revolutions by natural philosophers like Copernicus, Galileo, Darwin, and Einstein.
Credits: 3.0
Lec-Rec-Lab: (3-0-0) 
Semesters Offered: Spring - Offered alternate years beginning with the 2014-2015 academic year
Restrictions: May not be enrolled in one of the following Class(es): Freshman

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 - Offered alternate years beginning with the 2011-2012 academic year
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): SS 2600 or 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
Restrictions: May not be enrolled in one of the following Class(es): Freshman

SS 3612 - International Relations
An introduction to the field and study of International Relations (IR). This course will cover major IR theories and current topics in global politics including: globalization, terrorism, human rights, and environmentalism.
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

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

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
SS 3650 - Intellectual Property Management
Covers principles of intellectual property law, addressing managerial and policy issues in copyright, trademark, trade secret, and patents. Readings and discussions also cover how these property and legal systems impact the balance between property exclusivity, technological innovation, and public access.
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

SS 3660 - 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 2013-2014 academic year
Restrictions: May not be enrolled in one of the following Class(es): Freshman

SS 3661 - Civil Rights & Civil Liberties
Seminar focused on the rights and liberties guaranteed by US Constitutional amendments. Students learn constitutional theory and interpretation on topics of privacy, speech, media, religion, criminal justice, and gender/ethnic equality. Constitutional Law I is not required.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2014-2015 academic year
Restrictions: May not be enrolled in one of the following Class(es): Freshman

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): SS 2700

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, Summer - Offered alternate years beginning with the 2002-2003 academic year
Restrictions: May not be enrolled in one of the following Class(es): Freshman

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): SS 2700

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

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

SS 3801 - Science, Technology, & Society
Examines the relationship between science, technology, society, and the environment. Topics may include effects of technologies such as computers, biotechnology, and chemicals on society and nature, science and technology policy, and the history of technology and its global consequences.
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 1015 or UN 2001

SS 3820 - Ethical, Legal and Societal Implications (ELSI) of Nanotechnology
Exploration of the implications of molecularism—the perception of atoms and molecules as new targets of governance through precise engineering—brought about by emergent nanotechnology and nanoscience.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2014-2015 academic year
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): UN 1015 or UN 2001

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

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: On Demand
Pre-Requisite(s): SS 2100 or SS 2200
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
Semesters Offered: Fall, Spring - Offered alternate years beginning with the 2010-2011 academic year
Restrictions: May not be enrolled in one of the following Class(es): Junior, Senior

SS 3951 - Topics in European History
Examines important themes, topics, or eras in European history, from late Antiquity to the present. Topics may include intellectual history, revolutions, monarchy, military history (incl. the Crusades), or migrations. May be repeated if topic differs. See department for current offering.
Credits: 3.0; Repeatable to a Max of 6
Semesters Offered: Fall - Offered alternate years beginning with the 2010-2011 academic year
Restrictions: May not be enrolled in one of the following Class(es): Freshman

SS 3952 - Topics in World History
Examines major ideas, processes, and events in world history. Topics may include trade and commodities, imperialism, slavery, migration, or other subjects with transnational significance. May be repeated if topic differs
Credits: 3.0; Repeatable to a Max of 6
Semesters Offered: Spring - Offered alternate years beginning with the 2010-2011 academic year
Restrictions: May not be enrolled in one of the following Class(es): Freshman

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

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
Semesters Offered: Spring - Offered alternate years beginning with the 2000-2001 academic year
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior

SS 4010 - Quantitative 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. Assumes familiarity with Social Sciences concepts.
Credits: 3.0
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): PSY 2720 or MA 2720 or BUS 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
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)

SS 4030 - Senior Seminar in Anthropology
Capstone course for anthropology majors. Students examine career and graduate studies in anthropology and prepare proposal for senior research project.
Credits: 2.0
Semesters Offered: Spring - Offered alternate years beginning with the 2007-2008 academic year
Restrictions: May not be enrolled in one of the following Class(es): Junior

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
Semesters Offered: On Demand

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
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman

SS 4201 - Global Change in Culture and Society Since 1400
Explores the increasing interconnectedness of world cultures since 1400. The course examines the social, economic, and political changes that accompanied the rise of world capitalism from multiple theoretical perspectives. Themes include colonialism, agency, resistance, world-systems theory, and globalization.
Credits: 3.0
Semesters Offered: Spring - Offered alternate years beginning with the 2010-2011 academic year
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): SS 2100

SS 4210 - Global Change in Culture and Society Since 1400
Explores the increasing interconnectedness of world cultures since 1400. The course examines the social, economic, and political changes that accompanied the rise of world capitalism from multiple theoretical perspectives. Themes include colonialism, agency, resistance, world-systems theory, and globalization.
Credits: 3.0
Semesters Offered: Spring - Offered alternate years beginning with the 2010-2011 academic year
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): UN 1025 or UN 1002

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SS 4211 - Ethnographic Methods
Field-based course that surveys basic concepts of ethnography and applies them in a class research project. Provides practical experience in field observation, interviews, field notes, and write-up of research.
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

SS 4220 - Method & Theory in Archaeology
This course explores themes concerned with the intellectual development of archaeology, including research methods, theoretical concepts, and problems that have characterized the history of the discipline. Particular emphasis is placed on the broader social contexts in which archaeology has developed.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall - Offered alternate years beginning with the 2009-2010 academic year
Restrictions: May not be enrolled in one of the following Class(es):
Freshman, Sophomore

SS 4380 - Landscape Ecology and Planning
Basic principles of landscape ecology, including pattern, process, and scale. Students will learn how to use quantitative tools to study landscape-scale patterns and processes, and how to apply these principles and tools to conservation, resource management, and planning issues.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2013-2014 academic year
Restrictions: May not be enrolled in one of the following Class(es):
Freshman

SS 4390 - Seminar in Sustainability Issues
An intensive seminar focused on a sustainability issue or field, such as sustainable development, environmental justice, globalization, or other current and relevant topics. May be repeated if topic differs.
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

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

SS 4501 - Senior Thesis - History
Directed study leading to production of a senior thesis for history majors.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Restrictions: Must be enrolled in one of the following Major(s): Liberal Arts with History Opt; Must be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): SS 4500(C)

SS 4502 - Historical Research
This course supports historical research in conjunction with any upper-division history seminar. Students must take both courses simultaneously, and will work directly with the instructor to produce an original research paper.
Credits: 1.0; May be repeated
Lec-Rec-Lab: (0-1-0)
Semesters Offered: On Demand
Restrictions: Permission of instructor required; May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): SS 2500 or SS 2501 or SS 2551 or SS 2552 or SS 2560 or SS 2561

SS 4635 - Environmental Diplomacy and Law
This course delves into the international law associated with environmental issues. Students begin with the treaty language and associated jurisprudence (if any) and then move to how the treaty was negotiated, adapted by national governments, and used in political discourse.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2011-2012 academic year
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): SS 3610(C)

SS 4636 - Perceptions of The Modern State and Governance
Classic and contemporary theories of the state and approaches to governance are examined.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall

SS 4700 - Communities and Research
A rural sociology course analyzing the sustainability of rural communities (socially, environmentally, economically, and culturally). The course involves participatory research conducted together with a local community organization. Students practice research skills while making a difference in improving community life.
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

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

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, Anthropology; 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): Liberal Arts with History Opt, Social Sciences

SS 4921 - Washington Experience - Professional Practicum
Practicum participants experience professional hands-on learning as intern in governmental, public-interest, non-profit, or national organization in DC or select cities abroad. Internship placements made through approved affiliate institution providing placements, mentorship, supervision, classes, orientation, and housing for MTU's DC interns.
Credits: variable to 15.0; Repeatable to a Max of 15
Semesters Offered: On Demand
Restrictions: Permission of department required

SS 4990 - Directed Study in Anthropology
An original study of an anthropological problem, including literature search, data collection, and analysis, culminating in a research report.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of instructor required; Must be enrolled in one of the following Class(es): Senior

Service Systems Engineering

SSE 2100 - Industrial and Service Systems
This course provides an overview of the systems engineering process, an introduction to the service sector as an engineering field, and basic manufacturing processes. Systems Engineering approaches common to industrial and Service Systems will be emphasized.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall

SSE 3200 - Analysis and Design of Web-based Services
The strategy behind developing web-based service systems will be the focus of the course. Topics will include flowcharting, cost estimating, performance measurement, database management, and alpha and beta testing. A semester project will illustrate the use of these tools.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Pre-Requisite(s): CS 1121(C) or CS 1131(C)

SSE 3400 - Human Interactions in Service Systems
Service system customers and employees can benefit from user-centered design. This course explores both the psychological and physical characteristics of human beings, as well as cultural influences on their behavior. It introduces data collection methods such as surveys, focus groups, and structured interviews. It then presents how to apply human factors principles to the design process.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Pre-Requisite(s): PSY 2000 and (MEEM 2110 or ENG 2120)

SSE 3500 - Service System Operations
Focuses on the operation of service systems in a customer-focused environment. Topics will include work measurement, performance management, and process evaluation and improvement. Supply chain, demand management and lean practices will also be introduced.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Pre-Requisite(s): BA 3610 or OSM 3000

SSE 3730 - Systems Dynamics and Design
Introduces principles of systems engineering as applicable to studying the behavior of engineering systems such as transportation, utility, service, construction, and project management systems. Students are introduced to Queueing Theory, Markov Chains, and System Dynamics.
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): BUS 2100(C) or BA 2100 or MA 3710(C) or MA 2720(C) or CE 2710(C) and (MA 1135 or MA 1160 or MA 1161)

SSE 4300 - Project Planning and Management for Engineers
The various stages in a project life cycle will be defined and explored such as planning, metrics, execution, completion, and maintenance. Basic tools such as CPM, PERT, Gantt, and budgeting will be introduced. Change assimilation in the context of project management will also be discussed. Not open to students with credit in BA3620 or OSM3200.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Summer
Pre-Requisite(s): MA 2720 or MA 3710 or BA 2100 or BUS 2100

SSE 4750 - Risk Analysis and Management
Fundamentals methods in analyzing and mitigating risks involved in services that function at the interface of human, natural and engineered systems. Relevant systems include transportation, service, utility, emergency and hazard management, and project management.
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): OSM 3730 or CE 3730 or SSE 3730 or SSE 2300

SSE 4760 - Optimization Methods in Design and Decision Making
Decision analysis and optimization techniques, including linear programming, nonlinear programming, and dynamic programming. Computer-based solutions of design problems in various engineering specialty areas are considered.
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): MA 2160 and (MA 2320 or MA 2321 or MA 2330)

Surveying

SU 2000 - Introduction to Surveying
Surveying topics will include distance measurements, leveling, angles, directions, traversing, horizontal and vertical curves, percent grade, and coordinate geometry.
Credits: 2.0
Lec-Rec-Lab: (0-1-2)
Semesters Offered: Fall, Spring

SU 2050 - Plane Surveying
An introductory course studying surveying instruments and their use in the measurement of angles, distances, and elevations. Topics include taping, leveling, traversing, construction surveys, route surveys, use of modern instrumentation, and computer applications.
Credits: 3.0
Lec-Rec-Lab: (0-1-6)
Semesters Offered: Fall
Pre-Requisite(s): SU 2000(C)
SU 2220 - Route and Construction Surveying
Study of the geometry and field stake-out techniques of circular curves, spiral curves, compound curves, reverse curves, equal-tangent vertical curves, 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 2050 or SU 2000

SU 3110 - Surveying Field Practice
Survey projects from field to finish using current surveying equipment and software. Basic statutes and ethics governing the practice of surveying. Projects cover level networks, horizontal control, design surveys, construction layout, section subdivision, map and report preparation.
Credits: 4.0
Lec-Rec-Lab: (0-2-6)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): SU 2220

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 and the role of the surveyor in issuing opinions on boundary location in boundary disputes.
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): SU 3600(C)

SU 3210 - Site Planning and Development
An examination of land development issues including: site analysis, environmental concerns, contouring, earthwork and grading, soils, route alignments, storm water management, sewer systems, zoning, and land planning. Incorporates CAD applications in the lab.
Credits: 4.0
Lec-Rec-Lab: (0-3-2)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): SU 2000

SU 3250 - Geodetic Adjustments Theory
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 principles.
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
Pre-Requisite(s): (MA 2320 or MA 2321 or MA 2330) and (MA 2720 or MA 2710 or MA 3710) and MA 3180 and SU 2260

SU 3540 - Geospatial Information Technology with Elements of Field Cartography
Application of GIS technology methods for processing surveying data obtained in the field. Concepts of interoperability and metadata organization are considered. Includes map projection review and 2D and 3D cartographic data visualization.
Credits: 4.0
Lec-Rec-Lab: (0-3-2)
Semesters Offered: Spring
Pre-Requisite(s): MA 3710

SU 3600 - Surveying Computations and Adjustments
Basic computations and analysis of surveying measurements by adjustment theory are introduced. Students will gain the ability to use computer software to perform the computations. Analysis of measurements and errors based on statistical principles and least squares principles will be discussed.
Credits: 4.0
Lec-Rec-Lab: (0-3-3)
Semesters Offered: Fall
Pre-Requisite(s): (SU 2000 or SU 2050) and MA 2320 and SU 3110(C) and MA 3160(C) and MA 3710(C)

SU 4003 - Geographic Information Systems (GIS) Technology Fundamentals
Course provides review of Geographic Information Systems applications and analysis. Includes core concepts such as data acquisition and management, topology, accuracy, metadata, output, quality control, analysis methods, new and traditional software options, web mapping, and GIS implementation/management for research and production.
Credits: 1.0
Lec-Rec-Lab: (0-1-0)
Semesters Offered: On Demand

SU 4010 - Geospatial Concepts, Technologies, and Data
High level review of geospatial data acquisition systems, sensors, and associated processing technologies. Course considers geospatial metadata generation principles, interoperability, and major tools for manipulation with geospatial data. Course may help in transition of non-geospatial majors to geospatial field.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Restrictions: Permission of instructor required

SU 4045 - Geospatial Data Fusion
Fundamentals of GIS data, aerial photographs, satellite imagery, airborne/terrestrial laser scanning data. Characteristics of remotely sensed data including information specific to the sensors used to obtain it. Term project on how to combine and fuse to a specific application.
Credits: 3.0
Lec-Rec-Lab: (0-2-1)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Class(es): Senior
Pre-Requisite(s): SU 4140

SU 4060 - 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, Spring
Restrictions: Must be enrolled in one of the following Major(s): Surveying Engineering; Must be enrolled in one of the following Class(es): Senior
Pre-Requisite(s): SU 3600(C)

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: Must be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): SU 4060(C)
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: (0-2-2) 
Semesters Offered: Fall

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): Senior, Senior 
Pre-Requisite(s): SU 3180 and (CMG 3200 or SU 3210)

SU 4480 - Geospatial Science and Technology to Support Land Cadastre
Introduction and description of land rights. Land ownership, land lease, land access, traditional rights, mortgaging and land as capital, boundary descriptions, Cadastre 2014 by FIG, different examples for cadastre types over the globe, and modern technical approaches will be covered. 
Credits: 3.0 
Lec-Rec-Lab: (0-3-0) 
Semesters Offered: On Demand 

SU 4900 - Capstone Design Project
An engineering design project which integrates multiple aspects of previous surveying coursework while working with an industry partner. Includes project description, project planning, field work, office analysis, computer-aided design, final project completion and oral presentation skills. 
Credits: 3.0 
Lec-Rec-Lab: (0-2-3) 
Semesters Offered: Fall, Spring 
Restrictions: Permission of instructor required; Must be enrolled in one of the following Major(s): Surveying Engineering; Must be enrolled in one of the following Class(es): Senior 

SU 4990 - Professional Practice Seminar
A review of the elements of the NCEES Fundamentals of Surveying examination which leads to licensure as a professional surveyor, as well as a review for the Michigan Tech Surveying Engineering Exit Exam which will be administered in this course. To be taken in final semester only. 
Credits: 3.0; Graded Pass/Fail Only 
Lec-Rec-Lab: (0-3-0) 
Semesters Offered: Fall, Spring 
Restrictions: Permission of instructor required; Must be enrolled in one of the following Major(s): Surveying Engineering; Must be enrolled in one of the following Class(es): Senior 

SU 4996 - Special Topics in Geospatial Technologies
Selected additional topics of interest in Geospatial Technologies based on student and faculty demand and interest. May be a tutorial, seminar, workshop, project, or class study. 
Credits: variable to 3.0; Repeatable to a Max of 6 
Semesters Offered: On Demand 
Restrictions: Permission of instructor required; Must be enrolled in one of the following Major(s): Surveying Engineering; Must be enrolled in one of the following Class(es): Senior 

SU 4997 - Independent Study in Geospatial Technologies
Independent study of an approved topic under the guidance of a Surveying Engineering faculty member. May be either an academic, design, or research problem/project. 
Credits: variable to 3.0; Repeatable to a Max of 6 
Semesters Offered: On Demand 
Restrictions: Permission of instructor required; Must be enrolled in one of the following Major(s): Surveying Engineering; Must be enrolled in one of the following Class(es): Senior

SU 4998 - Undergraduate Research in Geospatial Technologies
An undergraduate research experience in Geospatial Technologies. Under the guidance of a Surveying Engineering faculty member, students work on a selected/approved research problem or work directly with faculty on active research projects/grants. May require more than one semester to complete. 
Credits: variable to 6.0; Repeatable to a Max of 6 
Semesters Offered: On Demand 
Restrictions: Permission of instructor required; Must be enrolled in one of the following Major(s): Surveying Engineering; Must be enrolled in one of the following Class(es): Senior 

SU 4999 - Professional Practice Review
A review of all elements of the NCEES Fundamentals of Land Surveying examination, which leads to licensure as a professional land surveyor. 
Credits: 1.0; Graded Pass/Fail Only 
Lec-Rec-Lab: (0-1-0) 
Semesters Offered: Fall 
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior

TE 4996 - Special Topics in Technology
Selected additional topics of interest in Technology based on student and faculty demand and interest. May be a tutorial, seminar, workshop, project, or class study. 
Credits: variable to 3.0; Repeatable to a Max of 6 
Semesters Offered: On Demand 
Restrictions: Permission of instructor required; Must be enrolled in one of the following College(s): School of Technology; Must be enrolled in one of the following Class(es): Senior 

TE 4997 - Independent Study in Technology
Independent study of an approved topic under the guidance of a School of Technology faculty member. May be either an academic, design, or research problem/project. 
Credits: variable to 3.0; Repeatable to a Max of 6 
Semesters Offered: On Demand 
Restrictions: Permission of instructor required; Must be enrolled in one of the following College(s): School of Technology; Must be enrolled in one of the following Class(es): Senior 

TE 4998 - Undergraduate Research in Technology
An undergraduate research experience in Technology. Under the guidance of a School of Technology faculty member, students work on a selected/approved research problem or work directly with faculty on active research projects/grants. May require more than one semester to complete. 
Credits: variable to 6.0; Repeatable to a Max of 6 
Semesters Offered: On Demand 
Restrictions: Permission of instructor required; Must be enrolled in one of the following College(s): School of Technology; Must be enrolled in one of the following Class(es): Senior

UN 0500 - Effective Scholarship
Course meets federal requirements for responsible conduct of research training for graduate students. Course includes oral and written communication practice as well as opportunities to learn techniques for being successful in graduate school. Students who pass the course will be awarded a certificate of completion. 
Credits: 1.0; Graded Pass/Fail Only 
Lec-Rec-Lab: (0-2-0) 
Semesters Offered: On Demand 
Restrictions: Must be enrolled in one of the following Level(s): Graduate
UN 1000 - Frameworks for Success for ExSEL
Course that explores ways to become a more effective student. The course focuses on metacognition and individual learning styles, the skills and habits that support academic success, and utilizing campus resources. Counts as a free elective.
Credits: 1.0
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring, Summer

UN 1005 - Initiatives for Success
Course that explores ways to become a more effective student. The course focuses on metacognition and individual learning styles, the skills and habits that support academic success, and utilizing campus resources. This course includes a mandatory learning center appointment assigned upon registration. Course counts as a free elective.
Credits: 1.0
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring, Summer

UN 1010 - Creating Your Success for Learning Communities
First year seminar course that develops community among members of residential learning communities and provides an introduction for creating academic, professional, and personal success. This course is required for all first-year and transfer students (with less than 30 credits) students living in a residential learning community. Course counts as a free elective.
Credits: 1.0; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring, Summer

UN 1011 - Strategies for Success
Seminar course that provides a framework to assess the strategies a student is currently using to achieve academic, professional, and personal success. The course is designed to look at ways to improve upon a student's strategies for success or adopt new ones. This course is required for all first-year or transfer (with less than 30 credits) students who are on academic probation for the first time after fall or spring of their first year. This course is also available with permission from the Dean of Students, to any student who feels they would benefit from additional strategies for success. Course counts as a free elective.
Credits: 1.0
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring, Summer

UN 1012 - Academic Language & Practice
This course is designed for speakers of English as a second language admitted into academic study, not native speakers of English. It assesses language ability and focuses on academic language and practices.
Credits: 1.0
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Fall, Spring

UN 1015 - Composition
Provides direct instruction in composition. Students examine and interpret communication practices and apply what they learn to their own written, spoken, and visual compositions. Class projects ask students to communicate in a variety of modes and to attend to audience, purpose, and context.
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 1025 - Global Issues
Study of contemporary global issues, their origins, impacts, and solutions through the thematic and comparative exploration of worldview and culture, population, globalization, development, politics and global governance, environment, and sustainability. Emphasis on global literacy and information literacy.
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): Freshman

UN 1200 - Leading and Working in Teams
Develops group problem-solving skills. Stresses interpersonal skills and skill assessment, communication, group process and teamwork, and action planning. Uses active, hands-on learning.
Credits: 1.0
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Fall, Spring
Pre-Requisite(s): UN 1100

UN 1995H - Honors Institute Contract
Credits: 0.0; Graded Pass/Fail Only
Semesters Offered: On Demand

UN 2100 - Foundations of Technological Leadership
Course designed for students in the Pavlis program, to develop group problem-solving skills. Stresses interpersonal skills and skill assessment, communication, group process and teamwork, and action planning. Uses active hands-on learning.
Credits: 1.0
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Spring
Pre-Requisite(s): UN 1200

UN 2200 - Leadership, Culture, and Technology
This course provides students with an understanding of the nature and process of leadership, and an opportunity to assess personal leadership skills/potential and develop a personal model of leadership. Leadership in other cultures and use of appropriate technology will also be explored.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring
Restrictions: Permission of instructor required

UN 2525 - Career Development Foundations
Students will learn the process of career development and planning, which includes self-assessment, decision-making, job search strategies, and awareness of workplace issues.
Credits: 1.0
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Fall, Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman

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 - Offered alternate years beginning with the 2007-2008 academic year

UN 2900 - Special Topics in Humanities, Arts, and Social Sciences
Examines an important theme or topic in the humanities, arts, or social sciences at an introductory level.
Credits: 3.0; Repeatable to a Max of 6
Lec-Rec-Lab: (0-0-0)
Semesters Offered: On Demand

UN 2990 - Special Topics - Interdiscipl.
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 2995H - Honors Institute Contract
Credits: 0.0; Graded Pass/Fail Only
Semesters Offered: On Demand
UN 3000 - Pavlis Leadership and Project Development
Course for students in the Pavlis Leadership program for planning and development of projects to be implemented during the summer International experience and continued development of personal leadership skills.
Credits: 1.0
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): UN 2100

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
Pre-Requisite(s): UN 3000

UN 3100 - Foundations of Ethical Leadership
Seminar course designed for participants in the Pavlis program. Builds upon topics covered in UN2100 with an emphasis on the principles of ethical leadership. Covers topics of ethics in communication, technology, the environment, and economics in today's interconnected, globalizing world.
Credits: 1.0
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Spring
Pre-Requisite(s): UN 3000

UN 3200 - Global Technological Leadership
This course, designed for students in the Pavlis program, covers topics of leadership including personality traits, interpersonal skills, leadership styles, teamwork, situational leadership, and decision making. Offers practical experience in project development, communication, and leadership development.
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
Pre-Requisite(s): UN 3100

UN 3404 - Cultural and Language Fundamentals
This course, designed for students in the Pavlis program, allows students to explore the culture of their international experience. Students will gain insight into working with and learning from different cultures to see the world and their leadership roles in new ways.
Credits: 2.0
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Summer
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): UN 3100

UN 3407 - Pavlis International Project Development
Course for students in the Pavlis Leadership program for refinement and finalization of projects to be implemented during the summer International experience.
Credits: 2.0
Lec-Rec-Lab: (0-0-4)
Semesters Offered: Summer
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior
Co-Requisite(s): UN 3404
Pre-Requisite(s): UN 3100

UN 3900 - Advanced Topics in Humanities, Arts, and Social Sciences
Examines an important theme or topic in the humanities, arts, or social sciences at an advanced level.
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

UN 3995H - Honors Institute Contract
Credits: 0.0; Graded Pass/Fail Only
Semesters Offered: On Demand

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 4060 - Pavlis Global Leadership Practicum
Students in the Pavlis program will plan and direct a leadership program on campus for high school students and spend time abroad participating in a variety of leadership experiences including at least one major leadership project.
Credits: 9.0
Lec-Rec-Lab: (0-0-27)
Semesters Offered: Summer
Pre-Requisite(s): UN 3404 and UN 3407

UN 4100 - Leadership Capstone Project I
This course, designed for students in the Pavlis program, is the first in a two part leadership capstone experience. Students engage in discussions and make oral presentations, outline a senior project report, mentor other students and apply their leadership skills by taking on leadership roles.
Credits: 1.0
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Class(es): Senior
Pre-Requisite(s): UN 4060

UN 4200 - Leadership Capstone Project II
This course, designed for students in the Pavlis program, is the second in a two part leadership capstone experience. Students engage in discussions and make oral presentations, write a senior project report, mentor other students and apply their leadership skills by taking on leadership roles.
Credits: 1.0
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Class(es): Senior
Pre-Requisite(s): UN 4100

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

UN 4995H - Honors Institute Contract
Credits: 0.0; Graded Pass/Fail Only
Semesters Offered: On Demand

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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 Michigan Tech 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. Contact the Registrar’s Office 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 Michigan Tech.

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 the first week</td>
<td>90%</td>
</tr>
<tr>
<td>Second week</td>
<td>80%</td>
</tr>
<tr>
<td>Third week</td>
<td>70%</td>
</tr>
<tr>
<td>Fourth week</td>
<td>60%</td>
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<tr>
<td>Fifth week</td>
<td>50%</td>
</tr>
<tr>
<td>Sixth 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 charges, and other penalties will be deducted from the refund of the deposit.

Credit Balance Refunds—Credit balance refunds resulting from the receipt 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. 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 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, receive failing grades in all courses 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 Loans, Federal Perkins Loan, Federal Pell Grant, Federal Supplemental Educational Opportunity Grant, Iraq Afghanistan Service Grant.

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 are viewed as 100 percent earned after that point in time.

The percentage of Title IV aid earned shall be calculated as follows:

\[
\frac{\text{Number of days completed by the student}}{\text{Total number of days in the semester}^*} = \text{Percent of Title IV aid earned}
\]

* 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 Registrar’s Office 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 (Graduate Student)
5. Direct PLUS Loan (Parent)
6. Federal Pell Grant
7. Federal SEOG
8. Iraq Afghanistan Service Grant

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 should 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 forty-five days of the date the University notifies the student of the overpayment status or the student risks 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.
Appendix B: Standards of Progress for Financial Aid

Satisfactory Progress Policy
Federal financial aid regulations require students to make satisfactory academic progress towards their degree to remain eligible for financial aid. Visit [www.mtu.edu/finaid/understanding/progress/](http://www.mtu.edu/finaid/understanding/progress/) to view the undergraduate and graduate satisfactory progress policies.

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 complete and the minimum cumulative GPA that must be attained by a student-athlete at Michigan Technological University by the end of each academic year to meet NCAA eligibility requirements.

<table>
<thead>
<tr>
<th>Entering 2nd Year of Collegiate Enrollment</th>
<th>Entering 3rd Year of Collegiate Enrollment</th>
<th>Entering 4th Year of Collegiate Enrollment</th>
<th>Entering 5th Year of Collegiate Enrollment</th>
</tr>
</thead>
<tbody>
<tr>
<td>• 24 semester credits</td>
<td>• 40% of degree requirements</td>
<td>• 60% of degree requirements</td>
<td>• 80% of degree requirements</td>
</tr>
<tr>
<td>• 18 credits earned during academic year</td>
<td>• 18 credits earned during academic year</td>
<td>• 18 credits earned during academic year</td>
<td>• 18 credits earned during academic year</td>
</tr>
<tr>
<td>• 1.80 GPA for graduation</td>
<td>• 2.00 GPA for graduation</td>
<td>• 2.00 GPA for graduation</td>
<td>• 2.00 GPA for graduation</td>
</tr>
<tr>
<td>• Six credits/term</td>
<td>• Six credits/term</td>
<td>• Six credits/term</td>
<td>• Six credits/term</td>
</tr>
<tr>
<td>• A maximum of six semester hours of remedial courses may be used in the first year</td>
<td>• Declaration of degree program</td>
<td>• Six credits/term</td>
<td></td>
</tr>
</tbody>
</table>

Division I — Men's Ice Hockey:
1. Must declare a major by the start of the third year to be eligible to compete.
2. Student-athletes must be in good standing with the University (not withdrawn or suspended).

Division II
A student-athlete must pass at least 24 credit hours of college work during the two (2) previous semesters or have an average of 12 credits each term attended (summer school can only account for 25 percent of the 24 credits) and maintain the following grade point average:

GPA Requirements for DII
1.80—After completion of 24 semester credit hours.
2.00—After completion of 48 semester credit hours, or thereafter.

Six Credit Hours Eligibility Requirement
All student-athletes currently enrolled must successfully complete at least six semester hours in the previous regular academic term of full-time enrollment to be eligible to participate in the next regular academic term. Student-athletes not meeting the satisfactory progress requirements because of mitigating or extenuating circumstances may request reinstatement by writing a letter of appeal to the Athletic Department, care of the Compliance Office, within one week of notification of loss of eligibility.
Veterans' Standards of Progress

The veterans' standards of progress are the same as for all other University students as listed under Academic Policies and Procedures.

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 remove himself or herself from probation, the US 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. All student veterans receiving benefits must schedule a minimum of 12 credits of their major core requirements to receive full benefits.

3. Repeated courses 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.

4. 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.finaid.mtu.edu.
Appendix C: Assessment, Leadership, Accreditation

Assessment
Michigan Technological University is committed to continuous improvement of its educational programs. An important part of our improvement effort is Michigan Tech's program for Assessment of Student Learning. Michigan Tech has eight University Student Learning Goals, including communication, critical and creative thinking, and global literacy. Faculty set learning goals for each degree program and also for each course, and Student Affairs also has learning outcomes for student life.

To measure students' success in achieving these learning goals, we collect samples of student work, administer special exams, and conduct student interviews and surveys throughout the year. The purpose of this assessment is to identify opportunities for improvement of our curricula and student life. The university also participates in national surveys such as the National Survey on Student Engagement.

The results of assessment activities are summarized annually and discussed by the faculty in each department as well as by the University Assessment Council in order to improve curricula and teaching practices that will enable students to achieve our student learning goals. The University administration reviews assessment results to make informed decisions about programs.

Board of Control
(All terms expire December 31 of year indicated.)

<table>
<thead>
<tr>
<th>Name</th>
<th>Term</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thomas L. Baldini</td>
<td>2009-2016</td>
</tr>
<tr>
<td>Julie A. Fream</td>
<td>2011-2018</td>
</tr>
<tr>
<td>Stephen J. Hicks</td>
<td>2007-2014</td>
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<tr>
<td>Robert J. Jacquart</td>
<td>2013-2020</td>
</tr>
<tr>
<td>Linda, D. Kennedy</td>
<td>2013-2020</td>
</tr>
<tr>
<td>Paul G. Ollila</td>
<td>2009-2016</td>
</tr>
<tr>
<td>Dr. Terry J. Woychowski</td>
<td>2011-2018</td>
</tr>
</tbody>
</table>

University Administrators
President, Glenn D. Mroz
Provost and VP for Academic Affairs, Maximilian J. Seel
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
Chief Information Officer, Walter W. Milligan

Faculty Administration

College of Engineering
Interim Dean, Wayne Pennington
Associate Dean Research and Graduate Programs, Carl L. Anderson
Associate Dean for Academic Affairs, Leonard J. Bohmann

Department Chairs
Biomedical Engineering, Sean J. Kirkpatrick
Chemical Engineering, S. Komar Kawatra
Civil and Environmental Engineering, David W. Hand
Electrical and Computer Engineering, Daniel R. Fuhrmann
Engineering Fundamentals, Jean-Celeste Kampe
College of Sciences and Arts

Dean, Bruce E. Seely
Associate Dean, Jason R. Carter

Department Chairs
Aerospace Studies (Air Force ROTC), Michael D. Brothers
Biological Sciences, Chandrashekhar P. Joshi
Chemistry, Cary Chabalowski
Cognitive and Learning Sciences, Bradley H. Baltensperger
Computer Science, Interim Charles R. Wallace
Kinesiology and Integrative Physiology, Jason R. Carter
Humanities, Ronald L. Stickland
Mathematical Sciences, Mark S. Gockenbach
Military Science (Army ROTC), James W. Spence
Physics, Ravindra Pandey
Social Sciences, Patrick E. Martin
Visual and Performing Arts, Anne Beffel

School of Business and Economics

Dean, R. Eugene Klippel
Associate Dean, Thomas E. Merz

School of Forest Resources and Environmental Science

Dean, Terry L. Sharik

School of Technology

Dean, James O. Frendewey

Graduate School

Dean, Jacqueline E. Huntoon

Library, J. R. Van Pelt and John and Ruanne Opie

Director, Ellen B. Marks

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, specific programs have been accredited, approved, or recognized by their respective agencies.

College of Engineering
The following engineering programs are accredited by the Engineering Accreditation Commission of ABET, 111 Market Place, Suite 1050, Baltimore, MD 21202-4012, telephone: (410) 347-7700.

- 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

College of Sciences and Arts
The Michigan Board of Education approves the teacher certification programs offered by the College of Sciences and Arts departments.

The teacher education program is nationally accredited by the Teacher Education Accreditation Council.

In Biological Sciences, the fourth-year instruction in the Medical Laboratory Science 3+1 option is carried out in hospitals accredited by the National Accrediting Agency for the Clinical Laboratory Sciences (NAACLS).

The Department of Chemistry offers American Chemical Society certified degrees and interdisciplinary options.

School of Business and Economics—AACSB International
The following bachelor and master degree programs in the School of Business and Economics are accredited by AACSB International - the Association to Advance Collegiate Schools of Business, the premier business accrediting organization in the US. Today, there are more than 1,320 members in 70 countries around the globe.

• accounting
• finance
• marketing
• management
• management information systems
• operations systems management
• Tech MBA and Tech MBA Online (Master of Business Administration)

AACSB International
777 South Harbour Island Boulevard, Suite 750
Tampa, FL 33602-5730 USA
813-769-6500; 813-769-6559 (fax)

School of Forest Resources and Environmental Science
The Society of American Foresters accredits the following degree programs at Michigan Tech:

• Bachelor of Science in Forestry
• Master of Forestry

Society of American Foresters
6400 Grosvenor Lane
Bethesda, MD 20814-2198
866-897-8720 (toll free); 301-897-3690 (fax)

School of Technology
The following engineering technology programs are accredited by the Technology Accreditation Commission of ABET, 111 Market Place, Suite 1050, Baltimore, MD 21202-4012, telephone: (410) 347-7700.

• electrical engineering technology
• mechanical engineering technology

The Construction Management Program is accredited by the American Council for Construction Education (ACCE), 1717 North Loop 1604 East, Suite 320, San Antonio, TX 78232-1570.