2007 UNDERGRADUATE CATALOG
2007-08 Academic Calendar

FALL SEMESTER 2007
August 26, Sunday - September 01, Saturday
August 29, Wednesday
September 03, Monday
September 04, Tuesday
September 07, Friday Noon
September 10, Monday
October 05, Friday 3:00 PM
October 08, Monday
October 15, Monday
October 19, Friday

October 22, Monday
October 28, Sunday - November 12, Monday
November 16, Friday 10:00 PM
November 26, Monday
December 14, Friday
December 15, Saturday
December 17, Monday - December 21, Friday
December 21, Friday

SPRING SEMESTER 2008
January 09, Wednesday
January 13, Sunday
January 14, Monday
January 21, Monday
January 22, Tuesday
February 06, Wednesday 10:00 PM
February 11, Monday
February 25, Monday
February 29, Friday
March 03, Monday
March 07, Friday 10:00 PM
March 17, Monday
March 31, Monday - April 13, Sunday
April 25, Friday
April 28, Monday - May 02, Friday
May 02, Friday
May 03, Saturday

SUMMER SEMESTER 2008
May 12, Monday
May 26, Monday
June 26, Thursday
June 27, Friday
<table>
<thead>
<tr>
<th>Event (Fall)</th>
<th>Event (Spring)</th>
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<tbody>
<tr>
<td>Orientation</td>
<td>Spring bills due</td>
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<tr>
<td>Fall Bills Due</td>
<td>Orientation</td>
</tr>
<tr>
<td>Labor Day</td>
<td>Instruction begins</td>
</tr>
<tr>
<td>Instruction Begins</td>
<td>K-Day recess begins</td>
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<tr>
<td>K-Day recess begins</td>
<td>Classes Resume</td>
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<tr>
<td>Homecoming Recess begins</td>
<td>Mid-Term grades available</td>
</tr>
<tr>
<td>Classes Resume</td>
<td>Part of Term A ends</td>
</tr>
<tr>
<td>Mid-Term grades available</td>
<td>Part of Term B - 2nd half begins</td>
</tr>
<tr>
<td>Part of Term A ends</td>
<td>Spring Break begins</td>
</tr>
<tr>
<td>Part of Term B - 2nd half begins</td>
<td>Classes resume</td>
</tr>
<tr>
<td>Spring and Summer semester registration</td>
<td>Fall semester registration</td>
</tr>
<tr>
<td>Thanksgiving recess begins</td>
<td>Last day of regular classes</td>
</tr>
<tr>
<td>Classes resume</td>
<td>Final Exam period</td>
</tr>
<tr>
<td>Last day of regular classes</td>
<td>Spring semester ends</td>
</tr>
<tr>
<td>Mid-year commencement</td>
<td>Spring Commencement</td>
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<tr>
<td>Final exam period</td>
<td>Full session begins/Session A begins</td>
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<tr>
<td>Fall semester ends</td>
<td>Memorial Day recess, 1 day only</td>
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<td></td>
<td>Session A ends</td>
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<td></td>
<td>Session A exam period</td>
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<tr>
<td></td>
<td>Session B begins</td>
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<tr>
<td></td>
<td>Independence Day recess, 1 day only</td>
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<tr>
<td></td>
<td>Session B ends/Full Session ends</td>
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<tr>
<td></td>
<td>Full Session, Session B exam period</td>
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</table>
Dear Students:

Michigan Tech is continually striving to provide the best education and supportive learning environment for our students. Welcome to a campus dedicated to exciting academic opportunities fulfilling your learning needs and preparing you to create a better future.

Academically, we have responded to students' changing educational needs by adding a number of new degree programs and courses. The School of Business and Economics is now offering an MBA degree; the Department of Social Sciences has a new bachelor's degree program in anthropology and a new Ph.D. program in archaeology, and the College of Engineering is rolling out its innovative Service Systems Engineering program.

The Rekhi Computer Science Hall is a stunning addition to campus architecture, and, together with the Dow Environmental Sciences Building and Dillman Hall, provides more than 43,000 square feet of teaching and research labs. Hesterberg and Homer Halls, which house a greenhouse and new soaring atrium for Forest Resources and Environmental Science, and the Rozsa Center for the Performing Arts, where touring musicals, plays, and other performances are featured every season, enhance your educational experience.

I encourage each of you to take a tour of the Michigan Tech campus and meet with our highly respected faculty members truly dedicated to student learning.

I sincerely hope you take advantage of our outstanding academic opportunities, expanding facilities, and numerous activities and events to make the most of your Michigan Tech education.

I wish you well!

Glenn D. Mroz, Ph.D., President
Academic Programs (Undergraduate)
Associate Degrees (AAS, AH)
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 & Learning Sciences (formerly Education)
  Computer Science
  Exercise Science, Health & Physical Education
  Humanities
  Mathematical Sciences
  Military Science (Army ROTC)
  Physics
  Social Sciences
  Visual & Performing Arts
School of Business and Economics
  Accounting
  Economics
  Finance
  Information Systems
  Management
  Marketing
  Operations & 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
About Michigan Tech

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

At its outset, the college trained mining and metallurgical engineers. Today, the University offers certificates, associate, bachelors, masters, and doctoral degrees in arts, humanities, and social sciences; business and economics; computing; engineering, forestry and environmental science, sciences; and technology.

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

About Houghton, Michigan

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

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

Houghton, rated the tenth-safest college town in the nation and the safest in Michigan, is part of the Houghton-Hancock twin-city center of approximately 12,000 residents. The University’s more than 6,000 students from many states and foreign countries make the area a vibrant, multicultural community. Houghton is home to many exciting cultural activities, from Bridgefest, a summer event commemorating the building of the Portage Lake Lift Bridge, to the annual fall Parade of Nations, a celebration of Michigan Tech’s diversity.

The campus and the surrounding communities provide a rich and inviting setting in Michigan’s storied northlands.
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 (Residential Services)  487-2682
International Programs and Services  487-2160
Student Records and Registration,
  Office of (OSRR)  487-2319

Colleges, Schools, Departments
College of Engineering  487-2005
  Biomedical Engineering  487-2772
  Chemical Engineering  487-3132
  Civil & Environmental Engineering  487-2520
  Electrical and Computer Engineering  487-2550
  Engineering Fundamentals  487-3057
  Geological & Mining Engineering &
    Sciences  487-2531
  Materials Science and Engineering  487-2630
  Mechanical Engineering-Engineering
    Mechanics  487-2551
College of Sciences and Arts  487-2156
  Aerospace Studies (Air Force ROTC)  487-2652
  Biological Sciences  487-2025
  Chemistry  487-2048
  Cognitive & Learning Sciences  487-2460
  Computer Science  487-2209
  Exercise Science, Health & Physical
    Education  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
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<tr>
<th>University Offices</th>
<th>Archives</th>
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<tr>
<td></td>
<td>Reference</td>
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<td>Lode (Student Newspaper)</td>
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<td>Mail Services</td>
<td>487-2348</td>
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<td>Memoria Union, Director</td>
<td>487-2543</td>
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<td>Museum, Seaman Mineral</td>
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<td>Ombudsperson</td>
<td>487-2043</td>
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<td>Parking Permits</td>
<td>487-2319</td>
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<tr>
<td></td>
<td>President's Office</td>
<td>487-2200</td>
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<tr>
<td></td>
<td>Provost's Office</td>
<td>487-2440</td>
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<tr>
<td></td>
<td>Public Safety</td>
<td>487-2216</td>
</tr>
<tr>
<td></td>
<td>Toll free (for prospective students only): 1-888-MTU-1885</td>
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<tr>
<td></td>
<td>E-mail: <a href="mailto:mtu4u@mtu.edu">mtu4u@mtu.edu</a></td>
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| Michigan Tech Switchboard | 906-487-1885 |

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<thead>
<tr>
<th>Emergency</th>
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<td>Public Safety 487-2216</td>
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<tr>
<th>Mailing Address</th>
<th>906-487-1885</th>
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<tr>
<td>(Name or department) Michigan Technological University</td>
<td>906-487-1885</td>
</tr>
<tr>
<td>1400 Townsend Drive</td>
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<tr>
<td>Houghton, MI 49931-1295</td>
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Academic Programs

The requirements for all associate and baccalaureate degree programs, as well as the requirements for certificates and minors, and contact information for each of the colleges and schools for the 2007-08 academic year are linked below.

- **Associate Degrees**
- **Baccalaureate Degrees**
- **Certificates**
- **Minors**
- **Colleges and Schools Contact Information**

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

Information is also available, by clicking on the appropriate link, on the following academic opportunities available to Michigan Tech students.

- **Cooperative Education (Co-op)**
- **Double Majors**
- **Second Degrees**
- **English as a Second Language Programs**
- **Michigan Tech Online Programs**
- **International Programs—Study Abroad**
- **MICUP Transfer Degree 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.
Associate Degrees

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

College of Sciences and Arts (PDF)
   Humanities—Associate Degree (SAH)

School of Technology (PDF)
   Engineering Technology (TAET)
Baccalaureate Degrees

Michigan Tech has a variety of four-year degree programs in major fields. This section presents the requirements for a Bachelor of Science or 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 within the major. Those students interested in obtaining double majors, adding a minor or certificate to their degree program, or pursuing a second degree, should consult with their academic advisors. Also see degree audit information and instructions.

School of Business and Economics (PDF)
Accounting (BBA2)
Economics (BEC)
Economics Secondary Education (BEC2)
Finance (BBA3)
Management (BBAB)
Management Information Systems (BBA5)
Marketing (BBAA)
Operations & Systems Management (BBAC)

College of Engineering (PDF)
Applied Geophysics (EAG)
Biomedical Engineering (EBE)
Biomedical Engineering Enterprise (EBEE)
Chemical Engineering (ECM)
Chemical Engineering Enterprise (ECME)
Civil Engineering (ECE)
Civil Engineering Enterprise (ECEE)
Computer Engineering (ECP)
Computer Engineering Enterprise (ECPE)
Earth Science Education (EGL2)
Electrical Engineering (EEE)
Electrical Engineering Enterprise (EEEE)
Engineering (EBS)
Environmental Engineering (EEN)
Environmental Engineering Enterprise (EENE)
Geological Engineering (EGE)

Geological Engineering Enterprise (EGEE)
Geology (EGL)
Manufacturing—Distance (EBS6)
Materials Science and Engineering (EMSE)
Materials Science & Engineering Enterprise (MSEE)
Mechanical Design—Distance (EBS2)
Mechanical Engineering (EME)
Mechanical Engineering Enterprise (EMEE)
Photonics (EEEP)

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

School of Technology (PDF)
Computer Network & System Administration (TCSA)
Construction Management—BS (TCMG)
Electrical Engineering Technology—BS (TEET)
Industrial Technology—BS (TINT)
Mechanical Engineering Technology—BS (TMET)
Surveying Engineering—BS (TSE)
College of Sciences and Arts (PDF)
Actuarial Science (SMA6)
Anthropology (SANT)
Applied/Computational Mathematics (SMA8)
Applied Physics (SAP)
Audio Production & Technology (SFAT)
Biochemistry (SCH2)
Biochemistry and Molecular Biology (SMBB)—Biological Sciences
Biochemistry and Molecular Biology (SMBC)—Chemistry
Bioinformatics (SBI)
Biology—Secondary Education (SBL7)
Chemical Physics (SCH4)
Cheminformatics (SCHI)
Chemistry (SCH)
Chemistry—Secondary Education (SCH3)
Clinical Lab Science 3+1(SCL8)
Clinical Lab Science 4+1(SCL9)
Clinical Lab Science—Secondary Education (SCL0)
Communication in Contemporary Culture (SCC1)
Communication in Human Interactions & Global Contexts (SCC2)
Communication Media (SCC3)
Computer Science (SCS2)
Computer Science Applications (SCS1)
Computer Science—Secondary Education (SCS4)
Computer Systems Science (SCSY)
Cytotechnology 3+1(SCL4)
Cytotechnology 4+1(SCL6)
Discrete Mathematics (SMA5)
Ecology (SBL3)
English (SHU1)
English—Secondary Education (SHU3)
Environmental Chemistry(SCH5)
Exercise Science (SESC)
Fish Biology (SBL8)
Fitness and Sports Management (SEH1)
General Biology (SBL1)
General Mathematics (SMA2)
Health and Physical Education—Secondary Education (SEH2)
History (SSSH)
Histotechnology 3+1(SCL5)
Histotechnology 4+1(SCL7)
Information Systems (SCS3)
Law and Society (SSS4)
Liberal Arts—Interdisciplinary (SHU2)
Mathematics—Education Preparation (SMA9)
Mathematics—Secondary Education (SMA7)
Microbiology (SBL4)
Molecular Biology/Biochemistry (SBL2)
Pharmaceutical Chemistry (SCHP)
Physics (SPH)
Physics—Secondary Education (SPH1)
Plant Sciences (SBL6)
Polymers (SCH1)
Pre-Professional (SBL5)
Psychology (SPSY)
Scientific and Technical Communication (BA) (STA)
Scientific and Technical Communication (BS) (STC)
Social Sciences—General (SSS)
Social Sciences—Secondary Education (SSS2)
Software Engineering (SCS5)
Software Engineering (SSEN)
Sound Design (SFSD)
Statistics (SMA3)
Theatre & Entertainment Technology (BA) (STFT)
Theatre & Entertainment Technology (BS) (SFET)
Certificates

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 & Economics (PDF)**
Certificate in International Business (CIB)

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

**College of Engineering (PDF)**
Certificate in Design Engineering—Distance (CDE)
Certificate in International Sustainable Development Engineering (CISE)
Certificate in Mine Environmental Engineering (CMEE)

**College of Sciences and Arts (PDF)**
Certificate in Actuarial Science (CASC)
Certificate in Advanced Modern Language—French (AFR)
Certificate in Advanced Modern Language—German (AGE)
Certificate in Advanced Modern Language—Spanish (ASP)
Certificate in Media (CMD)
Certificate in Modern Language—French (CFR)
Certificate in Modern Language—German (CGE)
Certificate in Modern Language—Spanish (CSP)
Certificate in Writing (CWR)
Coaching Endorsement (CCE)
Colleges and Schools

College of Engineering
Minerals and Materials Engineering Building, Room 712
906-487-2005
906-487-2782 (fax)

Dean - Timothy J. Schulz
Associate Dean - Carl L. Anderson

College of Sciences and Arts
Walker Arts and Humanities Center, Room 201
906-487-2156
906-487-3347 (fax)

Dean - Maximilian J. Seel
Associate Dean – Brad Baltensperger

School of Business and Economics
Academic Office Building, Room 103
906-487-2668, 2205
906-487-2944 (fax dept.)
906-487-1863 (fax dean)

Dean - Christa L Walck
Associate Dean - Terry D. Monson

School of Forest Resources and Environmental Science
U. J. Noblet Forestry Building, Room 127
906-487-2454 or 800-WOODSMI
906-487-2915 (fax)

Dean - Margaret R. Gale

School of Technology
Electrical Energy Resources Center, Room 426
906-487-2259
906-487-2583 (fax)

Dean - Scott J. Amos
Cooperative Education (Co-op)

Michigan Tech encourages academically qualified undergraduate and graduate students to participate in cooperative education, an experience which is increasingly becoming 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 University and a selected employer, work assignments are related to the student's major field of study and are varied to provide a range of training and experience.

Technical level and degree of complexity of work assignments are tailored to match the level of the student's training, progressing with each work assignment. Since the co-op student must complete essentially the same academic program as a non co-op student, the co-op student 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 freshman year coursework. Transfer students must complete at least one semester in residence at Michigan Tech. Students in the co-op program are expected to maintain a grade point average of 2.20 or better. Each semester of co-op carries two academic credits, six or more of which may be applied toward an academic degree, depending on the degree granting department. Graduate student requirements include obtaining the permission of your advisor, full-time student status while applying for and participating in the co-op assignment, and maintaining at least a 3.0 GPA. Graduate students may earn from one to six credits per co-op assignment.

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.

More than 400 students participate in this program each year. Michigan Tech has a cooperative education agreement with over 1000 companies and organizations in the United States. 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 Center's co-op website at http://www.career.mtu.edu/coop.php.
Double Majors

• A single Michigan Tech bachelor's degree with two majors is granted when all requirements of both majors are satisfied at the same time. A student who completes a double major will be awarded one diploma listing both majors, for example, “B.S. in Mechanical Engineering and 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. In the event that a student has completed the requirements for two different degree types, such as a B. A. and a B. S., the degree corresponding to the primary major will appear on the diploma.

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

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

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

Any subsequent changes to specified courses on the degree audit must be approved on a Petition to Alter Curriculum Requirements form by the academic advisor of the major department.
Second Bachelor's Degrees

Students seeking a second bachelor's degree from Michigan Tech may obtain this degree by earning a minimum of 25 percent of the credits required for the second degree. These credits may not duplicate credits used to complete the primary or prior degree. The department recommending the candidate for a second degree has final authority in determining the necessary requirements.

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

The English Language Institute at Michigan Tech offers English as a Second Language (ESL) courses throughout the year to students interested in preparing for undergraduate or graduate study and for those interested in study of the English language. The following options for study are available:

- Semester courses are offered at the beginning, intermediate, advanced, and academic support levels and follow the university academic calendar. With the assistance of an ESL advisor, students develop a plan for gradual transition from ESL to academic study.
- International transfer students may enroll in academic support courses while taking courses in their majors.
- Summer Intensive Language Experience (SMILE) is offered during the second half of the Summer semester to students with TOEFL scores of 500 or slightly below to prepare them for academic study. SMILE includes American culture and all language skills.

For more information visit the English as a Second Language Program's website at http://www.admin.mtu.edu/ips2/FAQs/Application_Procedure.htm#ug.

Michigan Tech Online
technonline.mtu.edu

Michigan Tech Online Learning is developing new and innovative technologies to deliver “live” and on-demand classes to degree and non-degree seeking students. Courses can be used toward certificate, BS, MS, and PhD programs. Both corporate sponsors and individuals are eligible. Please visit Tech Online Learning for more information.

International Programs—Study Abroad

www.ips.mtu.edu

With international experience increasingly desired by both students and employers, Michigan Tech makes a variety of study abroad opportunities readily accessible.

Michigan Tech offers over 80 international study opportunities in more than 30 countries, including Michigan Tech University led programs, exchanges with partner universities around the world, and carefully selected study abroad programs offered through member consortia. Students may study abroad for as little as 2 weeks or as long as a year. Program costs are variable; many are about the same as tuition and fees at Michigan Tech. Financial aid may be applied to the costs of study abroad, and additional scholarships are available to qualified students.

Knowledge of a foreign language is not necessary to study aboard, though foreign study is an excellent way to improve language skills. Many programs are taught in English. All study abroad courses must be approved prior to your departure and the credits earned while abroad may be used for major or minor requirements, general education, or free electives. International co-ops and internships are also available.

MICUP Transfer Degree Program

http://outreach.mtu.edu/micup

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

MICUP’s seven week on-campus summer program helps ease the transition from community college to a four year institution. Unlock Your Future offers career exploration, tutoring, comprehensive academic advising, a university residential experience, a summer undergraduate research internship with a Michigan Tech faculty member, and the opportunity to enroll in a 3-credit Michigan Tech summer course.

For more information, contact the Department of Educational Opportunity at 906-487-2920 or visit the website at http://outreach.mtu.edu/micup/.
Officer's Training (ROTC)
www.aux.mtu.edu/afrotc or www.aux.mtu.edu/armyrotc
The Reserve Officers' Training Corps (Army or Air Force) is open to all U.S. 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 either program may receive a commission as an officer in the army or 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 pre-physical therapy advisor, located in the Department of Exercise Science, Health and Physical Education, 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.
Secondary Teacher Certification
www.ed.mtu.edu

Specific major and minor 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 (formerly Education) for admission to these programs.

- Biology (BS in Biological Sciences or Clinical Laboratory Science)
- Chemistry (BS in Chemistry)
- Computer Science (BS in Computer Science)
- Earth Science (BS in Geology)
- Economics (BS in Economics)
- English (BA in Liberal Arts)
- Health and Physical Education* (BS in Health and Physical Education)
- Integrated Science (BS in Applied Ecology and Environmental Science or Engineering)
- Mathematics (BS in Mathematics)
- Physics (BS in Physics)
- Social Studies (BS in Social Sciences)
- Technology and Design (BS in Engineering)

*Teacher Certification Pending
Admissions - Getting In

Application Procedure www.admissions.mtu.edu

General information regarding freshman, transfer, international, and other types of undergraduate student admission:

1. Complete the Michigan Tech Application for Admission any time after June 1 preceding the academic year for which you plan to enroll.
2. Applicants are encouraged to apply online. The application fee is waived for students who submit an online application (www.mtu.edu/apply).
3. Applicants who do not apply online should submit a $40 nonrefundable application fee (check or money order) made payable to Michigan Technological University.
4. Submit official ACT or SAT test scores.
5. Prospective Freshmen: Submit Secondary School Information page and fee (if applicable) to high school counselor or principal.
6. Prospective Transfers: Submit application, official transcripts, and fee (if applicable) to Michigan Tech Admissions Office.

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 varied 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 current Graduate School Catalog):

- **Application Forms**—Applications may be obtained from the Michigan Tech Admissions Office or online (www.mtu.edu/apply).
- **Credentials**—Materials to accompany the application include the high school counselor information page, high school transcript(s) and official SAT or ACT scores (see below)
- **Test Scores**—Scores from the SAT or the ACT 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 SAT is 1464; for the ACT it is 2030. Test registration forms are available at high school counseling offices or from the testing agencies.
  - SAT—http://www.collegeboard.com/student/testing/sat/about.html
  - ACT—http://www.actstudent.org/index.html

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

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

Homeschool Policy—Michigan Tech welcomes and encourages homeschooled students to apply for undergraduate admission. Homeschooled students must supply:
1. 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. A student may apply while final coursework is still in progress.

2. 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 not acceptable.

3. College transcripts if any college-level coursework has been taken.

4. Official final high school transcript indicating date of graduation.

**Freshmen Applicants for Admission**

**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.

**Computer Literacy** — 1 year of hands-on experience strongly recommended

**English** — 3 years required (literature, composition, language usage, essay/theme writing including a research paper, and 1/2 year of speech); 4 years strongly recommended

**Fine/Performing Arts** — 2 years strongly recommended

**Foreign Language** — 2 years strongly recommended

**Mathematics** — 3 years required; 4 years strongly recommended

**Natural Science** — 3 years strongly recommended (including 1 year of biological sciences and 1 year of chemistry or physics)

**Social Studies** — 3 years required (US and world history strongly 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, when 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. Students who complete a full year calculus course should inquire about advanced placement at Michigan Tech.

**Official High School Transcript**—must be submitted with all freshman applications in addition to all requirements listed under General Information (Application Forms, Credentials, and Test Scores.) Applicants will be notified of their admission status as soon as completed credentials are received and evaluated by the admissions staff—typically within 2-3 weeks.
Transfer Applicants for Admission

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

Applicants must also submit their high school transcripts unless they have earned an associate or higher degree from an accredited college or university prior to the time of application. Official transcripts from each previous college attended must be sent to the Michigan Tech Admissions Office. All transcripts become the official property of Michigan Tech and will not be returned or forwarded to another institution or party.

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

1. **Specific or approved course credit** is granted for courses taken (including online courses) in which passing grades of C (2.00/4.00 scale) or higher have been obtained, provided the courses are equivalent in content, length, and prerequisites to courses offered at 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.

2. **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. All of the recommended courses will transfer and apply toward the intended program of B.S. or B.A. study. Admissions advisors visit most Michigan and several out-of-state community colleges to provide special counseling and services.
International Students

International Programs and Services (IPS) is responsible for recruiting, admitting, and supporting international students on campus. IPS requests and sends I-20 and DS2019 forms and is the University's official representative for the Department of Homeland Security, U.S. Citizenship and Immigration Services (USCIS). All international students must check into IPS upon arrival and will communicate regularly with IPS throughout their stay at Michigan Tech in order to meet compliance requirements for maintaining visa status. IPS conducts foreign transcript evaluations and processes transfer credit from foreign institutions. IPS provides airport transportation for international students upon initial arrival, offers a thorough international orientation, and maintains an extensive support structure to help international students adapt to and become integrated into the Michigan Tech community.

Admissions Criteria—International applicants must:

- Apply online at [www.ips.mtu.edu](http://www.ips.mtu.edu)
- Satisfy entrance requirements comparable to those required for students from the U.S. (including application forms available at [www.ips.mtu.edu](http://www.ips.mtu.edu), provide credentials and produce official test scores).
- Submit official TOEFL scores or other proof of English proficiency
- Establish their ability to cover all expenses for their first year (or in some instances two years) of study at Michigan Tech
- Satisfy U.S. embassies’ requirements for visa issuance, including certification of financial support

Admissions Procedure

- Six to twelve months before desired initial enrollment term:
  - Submit an Undergraduate Application and prepare
  - Send all other required documents
  - Other information, including a checklist, and all necessary forms can be accessed at our web site [www.ips.mtu.edu](http://www.ips.mtu.edu).
- Completed applications for admission for Fall semester are due by June 1
- Completed applications for admission for Spring semester are due by October 15
- Incomplete applications will be considered for admission the following semester.
- Non-native English speakers must take the Test of English as a Foreign Language (TOEFL) or IELTS, TOEIC, MELAB, or SAT1 to demonstrate English Language Proficiency and should have the score officially reported to Michigan Tech (Michigan Tech school code for submission of test scores: 1464). A score of 61 or higher on the internet-based TOEFL generally is considered satisfactory for undergraduate admission to the University.* Obtain information regarding this test at [www.ets.org/toefl](http://www.ets.org/toefl). Send certified English translations with all credentials written in another language.

* Accepted students with no or a low TOEFL score or other scores will be admitted to the English as a Second Language program, with conditional admission to their requested degree program two semesters later. Michigan Tech's ESL program may be 1, 2 or 3 semesters in duration, depending on the entry level of the individual student. Upon successful completion of the ESL program, including earning a qualifying TOEFL (or other) score, the student will be able to enroll in a degree program. Michigan Tech is a certified testing site for the TOEFL-iBT. See [http://www.hu.mtu.edu/hu_dept/esl/Welcome.html](http://www.hu.mtu.edu/hu_dept/esl/Welcome.html).

Admitted International Students—An applicant is admitted to Michigan Tech only when he or she has submitted all application materials by the deadline 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.

Students must pay the enrollment deposit 30 days before indicated "arrive by" date to retain program enrollment status and housing reservation requests. The deadline for receipt of enrollment deposit for Fall semester is July 15. For Spring semester, the deposit must be received by December 11.

Upon arrival to Michigan Tech's campus, accepted international students must report to the International Programs and Services (IPS) office.
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. A Michigan Uniform Undergraduate Guest Application form may be obtained from the Admissions Office at Michigan Tech or from any other college or university in Michigan.

**Nondegree Students**
Individuals who are not candidates for a degree and who wish to apply for part-time study (carrying less than 12 hours of credit) are permitted to do so if openings are available and prerequisites have been met.

*Part-time, nondegree seeking students* should complete and submit an Application for Admission form to the Admissions Office, but they are not required to submit high school and college transcripts. However, if they later desire to become full-time or degree-seeking students, they must satisfy the same requirements as regularly enrolled students and receive official approval from the Admissions Office.

*High school students* may be admitted to specific courses on a concurrent/dual enrollment basis with their high school, provided they also receive permission from their high school principal.

**Former Students (Readmission)**
Any University student whose enrollment is interrupted for one or more semesters must be readmitted to Michigan Tech through the Office of Student Records and Registration. 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 Office of Student Records and Registration at 906/487-2319. Official transcripts from all schools attended and for all credit earned since leaving the University should be submitted to Transfer Services.

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

**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 2–3 weeks.

*Acceptance Packet*—Upon acceptance to Michigan Tech, students receive information regarding the steps necessary to enroll as well as details about course selection, extracurricular activities, housing and dining options.
Criteria for Financial Aid

**Freshmen**—Recipients of freshman awards are selected on the basis of high school class rank, high school cumulative grade point average, national test scores, special criteria established by sponsors of scholarships, and/or financial need. 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 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 current or former students of Michigan community colleges. Recipients of new transfer awards are selected on the basis of college academic record. Students must apply to Michigan Tech by February 15 preceding the academic year in which the applicant plans to enroll at the University.

**Enrolled Students**—Enrolled students who indicate their intention to return 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 early July.

**Scholarships/Grants**

Michigan Tech offers scholarships sponsored by the University, individuals, companies, and by local, state, and federal agencies. The following is a selected list; for a complete list of scholarships and more information on application procedures, visit [www.finaid.mtu.edu](http://www.finaid.mtu.edu).

**Michigan Tech Leading Scholar Awards**—Merit-based awards covering full-time tuition, room and board, and a $1000 per year stipend, to be used for any curriculum are given to Michigan residents who are members of the current year's graduating class from Michigan high schools. Candidates must be recommended for the award by a high school teacher by mid-October of senior year.
Presidential Scholars Program—Merit-based awards varying from $1,000 to $4,000 to be used for any baccalaureate curriculum are given to Michigan residents who are members of the current year's graduating class from Michigan high schools.

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

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

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

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

National Scholars Awards—Merit-based awards are given to non-Michigan residents of the U.S. 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 $6,000 to $12,000. Transfer students must have a minimum cumulative grade point average of 3.00 (4.00 scale), based on full-time enrollment for at least two semesters. Transfer students awardees receive $6,000.

University Student Awards—This program is designed to provide financial assistance to incoming students and currently enrolled students at Michigan Tech, based on academic potential and financial need. The amount of each award is variable, depending on need, up to the amount of full tuition for Michigan residents and the difference between Michigan resident tuition and nonresident tuition for students paying nonresident rates. Recipients of this award must attend full time, reapply each year, and meet the required minimum 2.00 cumulative GPA.

Michigan Competitive Scholarships—These scholarships range in value from $100 to $1,300. Applicants must have (1) been continuous residents of Michigan for one year; (2) taken the American College Test (ACT) by October of their senior year of high school (or earlier) and attained a qualifying score; (3) not attended a postsecondary educational institution following high school and prior to the ACT; (4) complied with all regulations of the Michigan Higher Education Assistance Authority; and (5) demonstrated financial need through a need-analysis form (such as the FAFSA). Students must meet the satisfactory progress requirements of this program.

ROTC Scholarships—These include scholarships for both U.S. Air Force and Army programs.

- The US Air Force offers 2 to 5 year scholarships for students who qualify for an Air Force commission. Scholarships range from $3,000 per year up to full tuition and lab fees. Scholarship students also receive $750 per year for books. A $250 to $400 per month tax-free allowance is provided to all contracted cadets. High school students must apply for the scholarship by December 1 of their senior year. Interested college students may apply at any time. Interested college students may apply at any time. Students should contact the Air Force ROTC Department at (906) 487-2652 or visit their website at www.aux.mtu.edu/afcadets/.

- The Army ROTC offers scholarships which pay full tuition, fees and $900 in books per year. Scholarships are offered to 1st through 3rd year students who may need five years to complete their degree requirements. Once contracted, cadets will additionally receive a $300-$500 tax-free monthly stipend. High school students may apply for a four-year Army ROTC scholarship before December 31 of their senior year of high school. Contact the Army ROTC Department at (906) 487-2650 or visit their website at www.aux.mtu.edu/armyrotc/.
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 $4,310. A Pell Grant does not have to be repaid.

Federal Academic Competitiveness Grants—These grants are to full-time Pell recipients who are U.S. citizens and who have completed a rigorous secondary school program of study, graduated after January 1, 2005, and enrolled in an eligible program. The award for the first academic year of study is variable up to $750. To qualify for a second-year award, students must meet all previously defined conditions and have earned a 3.0 cumulative GPA at the end of their first academic year. The award is variable up to $1,300.

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.

National Science and Mathematics Access to Retain Talent Grants (National SMART Grants)—This federal program supports full-time Pell Grant recipients who are U.S. citizens enrolled in their third or fourth academic year of an eligible program and who are pursuing an eligible major with at least a 3.0 cumulative GPA. The award value can range up to $4,000 for each of the third and fourth academic years.

Michigan Educational Opportunity Grants (MEOG)—These grants provide aid to Michigan residents with exceptional financial need who are enrolled at least half time. The award is variable up to $1,000 a year.

Michigan Adult Part-Time Grants—Michigan residents with financial need who have graduated from high school at least two years prior to applying and will attend the University part-time (3–11 credit hours) can be eligible for this aid program which awards $600 per year.

TECHAID Student Loans—The University has need-based loan funds available to qualified students who are enrolled at least half-time. Loans will be determined on the basis of need.

Federal Perkins Loans—These need-based loans are provided by federal and University funds. Undergraduate students may borrow up to a cumulative maximum of $20,000. Interest does not accumulate until repayment period begins 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.

Work-Study Programs: Federal and Michigan—These programs, based on financial need, provide assistance through employment on campus. Every effort is made to place students in jobs related to their skills, interests, and field of study. Work-Study participants generally are employed between eight and ten hours per week and receive biweekly paychecks.

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

National Guard Programs—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—Financial assistance based on financial need is available to students who are qualified Native Americans. Students should contact their tribal education office for application procedures.
 Keeping Your Aid

Required Credits for Assistance—Students must be enrolled each semester in the number of credit hours listed below to receive the full value of their awards.

<table>
<thead>
<tr>
<th>Scholarship</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scholarships</td>
<td>12</td>
</tr>
<tr>
<td>Federal Perkins Loan or Tech Aid</td>
<td>6</td>
</tr>
<tr>
<td>Federal SEOG</td>
<td>6</td>
</tr>
<tr>
<td>Federal Pell Grant</td>
<td></td>
</tr>
<tr>
<td>Full grant</td>
<td>12</td>
</tr>
<tr>
<td>Three-quarter-time grant</td>
<td>9-11</td>
</tr>
<tr>
<td>Half-time grant</td>
<td>6-8</td>
</tr>
<tr>
<td>Less than half-time grant</td>
<td>1-5</td>
</tr>
<tr>
<td>University Student Award</td>
<td>12</td>
</tr>
<tr>
<td>Michigan Competitive Scholarship*</td>
<td>12</td>
</tr>
</tbody>
</table>

* Students carrying 6–11 credits may receive a reduced MCS award.


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

Class Standing—Determined by number of credit hours

- Freshman 0–29.99 credits
- Sophomore 30–59.99 credits
- Junior 60–89.99 credits
- Senior 90+ credits

Full-Time Load—Defined as 12–18 credits per semester. When deciding the pace of academic advancement, students should consider their cumulative course workload as well as number of credit hours. Two hours of outside preparation are expected for each hour of lecture and recitation. A student in a 4-credit class would be expected to spend eight hours weekly in outside preparation.

Maximum Credit Load—The maximum load a student may carry will be subject to the following limits:

1. The student load is prescribed 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 Office of Student Affairs.

Academic Work

Attendance—Students are expected to attend all classes, including recitation and laboratory sessions, beginning on the first day of regular instruction as stated in the University Academic Calendar. The University shall not schedule, nor shall the student participate in, any official function during the scheduled final examination period. Events scheduled on dates that are out of University control are exempted.

Absences—If possible, students should contact the instructor prior to the absence and arrange a mutually acceptable make-up procedure. Otherwise, students should account for the absence at the first opportunity. Students who are unable to notify instructors concerning their absence from class or who must notify several instructors on short notice should contact the Office of Student Affairs. Students having excused absences, as defined in the Michigan Tech Student Planner & Handbook's "Attendance Policy" are permitted to make up graded work.

Academic Integrity—Students who cheat, plagiarize, or fabricate data as well as students who help others cheat, plagiarize, or fabricate can receive sanctions ranging from a warning to a special failing grade to expulsion from the University, depending on the severity of the offense. See the Michigan Tech Student Planner & Handbook or the Academic Integrity Policy.

Individual Efforts—The University expects that students' work on individual assignments and examinations will be their own private efforts that will follow acceptable practices. While group efforts and study groups are often appropriate and acceptable, students are expected to submit their own work. At times, it is difficult to differentiate between legal study aids and illegal "scoop" (old course materials including tests and lab reports). When in doubt, confer with the course instructor.

Weather Closure Policy—The president, senior vice president/provost, or their designated representative may decide to declare University closure for a specified period of time (examples might include but are not limited to prolonged power outage, prolonged loss of heating capability, or closure of main highway due to inclement weather). Notification will be through local media. Faculty and students will be excused from reporting to class.
Academic Preparation

**Advising**  [www.sa.mtu.edu/dean/advising](http://www.sa.mtu.edu/dean/advising)

Upon enrollment, students are assigned academic advisors by their major departments. Students are urged to consult their advisors regarding all academic concerns.

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

MaCH-1 is a seven-week summer program offering math, chemistry, English, and/or PE for college credit to students who will be entering college the following fall. Participants are placed into a math course based on their ACT scores, providing the necessary background for a rigorous, university-level science or engineering program. A weeklong precalculus workshop is also offered. With small classes, frequent one-on-one tutoring, and seminars on college life, MaCH-1 offers 4-7.5 credits, gives students an opportunity to refresh mathematics skills or complete prerequisite courses, experience college life in a relaxed environment, and develop confidence in their abilities.

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

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

**Learning Centers**  [www.admin.mtu.edu/dos/learningctrs.htm](http://www.admin.mtu.edu/dos/learningctrs.htm)

Because the mind does not develop in isolation but as a result of our interactions with others, Michigan Tech has many learning centers offering peer and professional academic coaching through weekly appointments, team learning groups, and walk-in tutoring for the following areas: biological sciences, chemistry, civil and environmental engineering, computer science, electrical and computer engineering, mathematics, mechanical engineering, physics, and writing.

**ExSEL**  [www.exsel.mtu.edu/](http://www.exsel.mtu.edu/)

The 4S (Select Student Support Services) - ExSEL Program is designed to promote student success. ExSEL offers academic support through services such as peer mentoring, study groups, study skills and time management techniques, academic progress monitoring, campus resource referrals, campus and community involvement, and career and personal development seminars. The program is a comprehensive partnership of the Department of Educational Opportunity and the College of Engineering, College of Arts and Sciences, School of Business & Economics, School of Technology and School of Forest Resources & Environmental Science and is aimed at increasing student success and retention.

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.

**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 Office of Student Affairs at [www.sa.mtu.edu/dean/list/](http://www.sa.mtu.edu/dean/list/).

**Graduation with Honors**—Michigan Tech University 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, or be academically dismissed.

**Required Course Withdrawal**—The Office of Student Affairs may, on the recommendation of the department chair, require students to withdraw from any course or courses in which their preparation, progress, effort, or conduct is deemed unsatisfactory.

**Academic Probation**—Students who are not making satisfactory progress toward a degree are placed on academic probation. Academic probation is a strong warning to students that their scholastic performance is less than that expected by the University. Notices of academic probation are sent to students at the same time grades are available at the end of the semester. Failure to improve after receiving a probation notice can result in academic dismissal or suspension from the University (see below).

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

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

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

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

**Academic Suspension and Dismissal**—A student is eligible for academic suspension if the cumulative GPA is below 2.0 after a semester of academic probation or if the student is not restored to good academic standing after two semesters of probation regardless of the cumulative GPA. A student who receives a notice of academic suspension will not be permitted to enroll at the university for a specified period of time.

Upon receiving a first notice of academic suspension, a student must sit out for at least one semester, plus a summer. That is, a student suspended at the end of a fall semester may not re-enroll until the following fall, and a student suspended at the end of a spring semester may not re-enroll until the following spring. Upon receiving a second notice of academic suspension, a student must sit out two semesters, plus a summer. Upon reinstatement after a second suspension, failure to achieve good academic standing or show substantial academic progress within one semester will result in academic dismissal. There is no opportunity for reinstatement after academic dismissal.

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

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

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

The qualifications for Academic Renewal are:

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

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

Academic renewal is a policy of Michigan Technological University and as such may not be recognized by outside institutions or agencies (e.g., Michigan Department of Education, other universities and colleges).

Students may obtain a petition form through the Office of Student Records and Registration and must consult with their academic advisor prior to election of academic renewal. Student who left the university voluntarily may re-enroll by contacting the Office of Student Records and Registration. If they did not leave voluntarily they must seek re-enrollment through the Office of Student Affairs. Requests are evaluated on a case-by-case basis.

Conduct [http://sa.mtu.edu/dean/judicial/policies/](http://sa.mtu.edu/dean/judicial/policies/)

All members of the University community—students, faculty, staff, and administrative officers—are jointly involved in maintaining a moral and social pattern in keeping with acceptable conduct. Students are expected to exhibit behavior that is indicative of good citizenship and to accept personal responsibility for their conduct when found to be in violation of University community standards. The University reserves the right to discipline any student for violation of any rule, ordinance, or law, or for any conduct damaging to the University, by such means as it considers suitable, including dismissal. Refer to the Michigan Tech Student Handbook, "Student Rights and Responsibilities in the University Community" section, and the Academic Integrity Policy and Procedures Guide for more information on disciplinary procedures and specific policies.

Sex Discrimination/Sexual Harassment—Michigan Tech must provide a fair and responsible environment for all of its students. Federal and state laws prohibit discrimination in the use of educational facilities because of gender. Discriminatory treatment on the basis of one's status as cited in the Michigan Tech Equal Opportunity statement is prohibited. Title VII of the Civil Rights Act expressly prohibits sexual harassment. According to the Michigan Tech Sexual Harassment Policy, unwelcome sexual advances, requests for sexual favors, and other verbal and physical conduct of a sexual nature constitute sexual harassment when submission is either explicitly or implicitly a basis for academic advancement (e.g., for better grades, advancement in an academic program); or submission or rejection
affects the targeted person's employment (e.g., their evaluation, advancement, salary); or the conduct has the purpose or effect of unreasonably interfering with the targeted person's work performance or learning environment; or it creates an intimidating, hostile, or offensive work, academic, or residential living environment. For information on the University's sexual discrimination policies, see the Michigan Tech Student Handbook, "Student Rights and Responsibilities in the University Community" section or contact the offices of Affirmative Programs or Student Affairs.

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

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 "Michigan Tech Drug and Alcohol Policy" or the pamphlet, "Policy and Procedure concerning Drugs and Alcohol," available in the Office of Student Affairs.

Disabilities (ADA)

Michigan Tech complies with all federal and state laws and regulations regarding discrimination, including the Americans with Disabilities Act of 1990 (ADA). Michigan Tech is committed to a policy of educating individuals with physical or learning disabilities without discrimination. Students with documented disabilities should contact the Student Affairs Office/Dean of Students for assistance and accommodations. It is the student's responsibility to inform the Office of Student Affairs of their class schedule for each semester in which accommodations are sought.

Grade Reports

Mid-Semester Grades—Grades of "satisfactory" or "unsatisfactory" are given to all first-year students at mid-semester. Final letter grades are provided at the end of each semester.

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

Disputed Grades—A student having an error in a final course grade should contact the instructor as soon as possible but no later than one month after the beginning of the next semester. Graded student work (exams, papers, homework, etc.) that has not been returned to the student should be retained by the instructor of record for at least 30 days after the beginning of the next semester or until existing disputes have been resolved.

Official Transcripts—Transcripts are provided free of charge upon request from the Michigan Tech Office of Student Records and Registration. Transcript requests are processed as they are received, and turn around time is kept to a minimum. All financial obligations to the University must be satisfied before a transcript will be released.

Online Request—If you are a current student or a former student who attended 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 stuossr@mtu.edu or contact the Office of Student Records and Registration 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 Office of Student Records and Registration 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, Office of Student Records and Registration, 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)—given only when a student is unable to complete a segment of the course because of circumstances beyond the student's control. Course work must be made up by the close of the next 3 semesters in residence or the I grade becomes a failure (F). A grade of I may be given only when approved in writing by the department chair. Incomplete grades at graduation are considered F grades in the final GPA.
- IS (in-session)—given when course remains in session after the term's final grade deadline.
- X (condition)—no grade points/credit; given only when the student is at fault in failing to complete a segment of a course, but in the judgment of the instructor does not need to repeat the course. The X grade becomes a failure (F) if it is not made up within the next semester in residence. An X grade is computed into the GPA as an F.
- M (missing grade)—grade not submitted by instructor. See instructor for clarification.
- N (no grade)—no credit, no grade points; given when a student officially withdraws from the University after the regular drop period. In these cases, the registrar notifies the instructor that the student has withdrawn from the University and should receive an N grade if passing as of the date of withdrawal. The student's grade form will come to the instructor at the end of the course in the normal manner.
- P (progress)—may be used for approved 3000- or 4000-level project courses, where projects carry over for more than one semester.
- Q (inadequate progress)—may be used for approved 3000- or 4000-level project courses where projects carry over for more than one semester.
- W (late drop)—no credit, no grade points; indicates a course was dropped between the beginning of the fourth week and the end of the eighth week; after the eighth week, a student may only request a late drop from the Office of Student Affairs, which will consider only those requests that clearly involve extenuating circumstances beyond the student's control.
- Cr (credit)—by advanced placement or examination.
- S (satisfactory)—credit given, no grade points, and not included in student's GPA; given for courses taken under the Pass-Fail option. A grade of S is given for work equal to 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 Option—Courses are typically taken for audit by students wishing to refamiliarize themselves with the material. A course taken as an audit may be retaken at a later date for credit subject to the approval of the student's major department. Students auditing courses will be charged the same tuition as credit courses. Students have six weeks after classes begin to change their registration (audit versus letter grade). After that time, changes in registration must be approved by the instructor.

Pass-Fail Option—The purpose of the pass-fail option is to encourage the student to explore areas of study outside the major field without the pressure of competition for a letter grade. Students have one week after classes begin to change their registration (pass-fail versus letter grade). After that time, changes in registration must be approved by the instructor.

No course taken for a letter grade may be repeated under the pass-fail option. Courses must be elected with the approval of the advisor. The courses available under this option are elective courses not specifically named by the student's major department as required for a degree or otherwise excluded by the department (free electives only). No university-wide credit requirement can be met with an S grade.

Graduation Requirements

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

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

1. Thirty of the last 36 semester credit hours of academic work to be applied to the degree must have been completed at Michigan Technological University. Study abroad and co-op credits earned through Michigan Tech may be included in these 30 hours if the student has completed 30 credit hours of courses at Michigan Tech among the last 60 credit hours to be applied to the degree.
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. Petitions for exceptions must be approved by the department advisor and department chair or school dean and submitted for file with Degree Services.
2. Successfully complete the required University General Education requirements.
3. Attain a cumulative University GPA of at least 2.00, and a major department GPA of at least 2.00.
4. Comply with Michigan Tech's graduation residency requirements.
5. File an Application for Graduation with the Degree Services Office for each degree/certificate program enrolled in.
6. Have an approved Degree Audit on file in the Degree Services Office for each degree/certificate program in which enrolled.

Undergraduate Commencement Eligibility Requirements

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

www.admin.mtu.edu/em/students/graduation/eligibility.php

Michigan Tech conducts two commencement ceremonies each year which are held in the spring and fall semesters. Students completing all degree requirements in the spring or summer will be listed for the spring commencement ceremony and students completing their degree requirements in the fall will be listed for the fall commencement ceremony. Students who find it necessary to participate in a ceremony held prior to their graduation term due to extenuating circumstances must seek approval from the Associate Registrar for Degree and Curriculum Services.
- Be registered in the course(s) that will complete all outstanding degree requirements.
- Have all required degree paperwork on file in the Degree Services Office two semesters prior to the expected graduation term. **Required degree paperwork** includes an application for graduation and a department approved degree audit form for each degree being pursued and any applicable minor audit forms, double major audit forms, certificate forms, and petitions to alter curriculum requirement forms.

**Participation in a commencement ceremony is NOT equivalent to graduation. Since the ceremony occurs before final grades are submitted, it is not possible to determine if all degree requirements 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. They are:

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

2. The right to request the amendment of the student's education records that the student believes is inaccurate or misleading.
   a. To request the amendment of a record that they believe is inaccurate or misleading, students should write the University official responsible for the record, clearly identify the part of the record they want changed, and specify why it is inaccurate or misleading.
   b. If the University decides not to amend the record as requested by the student, the University will notify the student of the decision and advise the student of his or her right to a hearing regarding the request for amendment. Additional information regarding the hearing procedures will be provided to the student when notified of the right to a hearing.

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

4. The right to file a complaint with the U.S. Department of Education.

One exception which permits disclosure without consent is disclosure to school officials with legitimate educational interests. School officials are individuals employed by the University in an administrative, supervisory, academic/research, or support staff position (including law enforcement unit personnel and health staff); a person or company with whom the University has contracted (such as an attorney, auditor, or collection agent); a person serving on an official committee such as a disciplinary or grievance committee, or assisting another school official in performing their tasks.

The University may disclose education records in certain other circumstances, which are noted in the full text of Michigan Tech's Disclosure and Release of Student Information policy.

Students retain the right to file a complaint with the U.S. Department of Education concerning alleged failures by the University to comply with the requirements of FERPA. The name and address of the Office that administers FERPA is: Family Policy Compliance Office, U.S. Department of Education, 400 Maryland Avenue, SW., Washington, DC, 20202-4605

FERPA further provides that certain information designated as "Directory Information", concerning the student may be released by the University unless the student has informed the University that such information should not be released.

The University designates the following as public or "Directory Information": The student's name, address, telephone number, electronic mail address, hometown, age, college, major field of study, class (senior, junior, sophomore, 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," name and verification of enrollment status, except to school officials with legitimate educational interests and others as indicated above. To do so, a student must file a request to withhold directory information form with the Office of Student Records and Registration. Once filed, this request becomes a permanent part of the student's record until the student instructs the University, in writing, to have the request removed.

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

University Information & Freedom of Information Act
Michigan Tech is committed to maintaining a free exchange of information throughout the University community. 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 at the time of printing, unforeseen circumstances or low enrollments may cause the cancellation of some section(s) or course(s). Michigan Tech also reserves the right to change the days, times, rooms, or instructors of section(s) or course(s) as deemed necessary.

The Schedule of Classes can be found on the web at the Schedule Planning Center: www.admin.mtu.edu/em/students/plan/

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

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

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

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

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

During the first three weeks of a semester, courses dropped will not be recorded on the student's permanent record. Beginning the fourth week through the end of the eighth week of the semester, courses dropped will be indicated by a grade of W on the student's permanent record.
First-year students: During the first three weeks of instruction*, signature approval must be obtained from the student’s academic advisor. Students must be made aware of how dropping a course affects their progress toward graduation. After the third week of instruction*, signature approval must be obtained from the student’s academic advisor and the course instructor.

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

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

After the eighth week of a semester, a student may request a late drop from the Office of Student Affairs which will consider only those requests that clearly involve extenuating circumstances beyond a student's control. The 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—These courses are required to be satisfactorily completed before a student may register for a more advanced course. Students who earn a CD or D in a prerequisite course are encouraged to retake the prerequisite course before registering for the advanced course.

Concurrent prerequisite: a prerequisite that may be taken the same semester as the course requiring it.

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

The course instructor has the right to waive 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 their class without the student officially taking the prerequisite course.

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

Curriculum Changes—Undergraduate students considering a change 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 Change Authorization 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 Office of Student Records and Registration before Wednesday of the second week of instruction to be effective for that semester. Curriculum changes received after that time will be effective for the following semester.

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

For forms go to: www.admin.mtu.edu/em/students/graduation/majorchange.php
**Enrollment in Graduate Courses under "Senior Rule"**—While 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 Office of Student Records and Registration prior to the end of the 6th week of class for the term in which the class is taken. Upon submission, the student's academic record will be changed to show graduate status for the course(s) designated. Once the academic record has been changed to show graduate status for a particular course, it cannot be changed back to count toward an undergraduate degree, nor can courses from previous semesters be reclassified.

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 Office of Student Records and Registration 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.
Michigan Tech offers opportunities for students to participate in a multitude of activities. WebCal, an electronic calendar reached from Michigan Tech's homepage, lists University events, including student activities. Students are encouraged to add their own organization's events to this calendar.

More than 180 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. Many of these groups become involved in new student orientation, Homecoming, Winter Carnival, and other events.

USG is the voice of the student body. This group oversees the disbursement of the revenue collected through the student activity fee and works with student groups to help resolve issues. USG offices are located in the Memorial Union Building.

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

Few homecoming festivities on any campus can rival Michigan Tech's for zaniness and all-around fun! In addition to the Homecoming Court and football game, there are also a hobo parade, in which students dress in their worst clothes, a charity canned food drive, a cardboard boat race, a three-legged race, clothing strip relay, and a boisterous tailgate party before the big game.

During a designated weekend in the fall semester, parents and families are invited to the Keweenaw Peninsula to explore campus, attend cultural events, cheer the Husky teams to victory, cruise the Keweenaw Waterway, and tour the Copper Country as it shows off its vibrant fall colors. It is a weekend filled with fond memories of Michigan Tech and family fun, and it's a great opportunity to visit with Tech students.

The Winter Carnival started in 1922 and has grown to become one of the largest annual winter festivals in the nation. It features huge, intricate snow statues on campus and in the local area, a home hockey series against a tough WCHA team, men's and women's varsity basketball, skits, broomball and other sports, sleigh rides, a Winter Carnival Queen, and more midwinter fun than you'd think was possible! Winter Carnival is held in early February during a two day class break.

On a Friday afternoon late in spring semester, students end the academic year and welcome warmer weather by engaging in activities including pie-throwing at professors, mud volleyball (better know as oozeball), and listening to rock bands at the Spring Fling festival. Various student organizations participate in this light-hearted event with food and entertainment for a campus community eager to relax and have fun before the serious business of final exams begins.
Visual and Performing Arts [www.fa.mtu.edu](http://www.fa.mtu.edu)

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. Programs offered 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 U.P. and northern Wisconsin musical groups.

**Theater**—A varied season each year offers a full range of theatrical genres and styles including comedies, classics, musicals, and experimental productions. Guest artists are invited to perform with students. The Visual and Performing Arts Department also sponsors The Troupe, an improvisational ensemble.

**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 sponsoring the Great Lakes Showcase, an exhibition for professional artists.

Cultural Enrichment

The University sponsors a broad variety of cultural activities including art exhibits, dance and theater touring companies, musical ensembles, performing artists, and lectures by topical (and often controversial) speakers. The variety of offerings provides opportunities for students to broaden their cultural education and enjoy professional entertainment. Students are also involved in the programming, promotion, and production of cultural events.

Athletics [www.athletics.mtu.edu](http://www.athletics.mtu.edu/)

**Intercollegiate Athletics (NCAA) [www.athletics.mtu.edu](http://www.athletics.mtu.edu/)**

Michigan Tech has a thirteen-sport intercollegiate athletic program, highlighted by its Division I men’s ice hockey team, a program that has captured three national championships. Other men's programs include football, basketball, cross country, track and field, tennis, and Nordic skiing. A strong women's program, which participated in nine NCAA tournaments in basketball and five in volleyball in the 1990s, includes cross country, tennis, Nordic skiing, and track and field.

**Intramurals** [www.aux.mtu.edu/im](http://www.aux.mtu.edu/im/)

The Department of Physical Education, through its Intramural/ Recreational Sports Services Office, offers competition in more than thirty intramural events—from badminton to water polo—for Michigan Tech’s students, faculty, and staff. Stop by the Intramural Office, room 202, Student Development Complex for IM handouts and information.

**Recreational Facilities** [www.exsci.mtu.edu/facilities](http://www.exsci.mtu.edu/facilities/)

The University owns and operates multiple athletic facilities and recreation areas for the benefit of its students, faculty, and staff. Facilities include the Student Development Complex, the Gates Tennis Center, and numerous other indoor and outdoor facilities, both on and off campus, for team sports, skiing, golf, tennis, and bowling. Mont Ripley, Michigan Tech’s own ski slope and the only ski mountain in the Midwest owned by a university, is convenient to campus and enjoyed by skiers and snowboarders.

**Student Development Complex (SDC)—** A 235,000 square-foot, indoor sports arena located on the Michigan Tech campus. Students may use the facilities free of charge. The SDC features the following:

- weight room
- racquetball and squash courts
- basketball and volleyball courts
- running track
- swimming pool (8-lane, 25-yard)
- diving pool
- gymnasium
- dance room
- gymnastics room
• rifle range
• ice arena
• locker rooms with showers and saunas
• sports equipment rentals
• University Images (Michigan Tech apparel shop)

**Gates Tennis Center**—Located near the SDC, features:

• tennis courts, indoor (4) with a minimal fee
• ball machine
• locker rooms with showers
• pro shop for racquet stringing and repairs

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

• bowling alley (6 lane) in the Memorial Union Building
• golf course (18-hole), Portage Lake Golf Course south of Houghton
• downhill ski area at Mont Ripley
• cross-country ski trails (7.4 k) near the SDC
• tennis courts, outdoors
• play/practice areas
• softball fields
• football/track stadium

**Health Care**

**The Houghton Community Health Center**—Located on the Michigan Tech campus adjacent to the SDC on MacInnes Drive, the Health Center is open Monday through Friday from 8:30 am to 5:30 pm and 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 the Portage Health System and are not billed by the university (906-483-1860).

An after-hours walk-in clinic and hospital emergency care are provided by Portage Health at 500 Campus Drive, Hancock, (906-483-1000). [www.portagehealth.org](http://www.portagehealth.org).

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

**Housing** [www.housing.mtu.edu](http://www.housing.mtu.edu)

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

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

**Housing Contract**—A housing application and contract for accommodations in a residence hall will be sent by the Admissions Office when the applicant is accepted for admission. Priority residence hall and roommate preference requests are considered based on the date a completed contract is received.

**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 rooms with a private bath. All residence halls are smoke free environments.

**LIFESTYLE OPTIONS**—Unique living options include the Community Governed Area, several substance-free housing areas and the Learning Communities.

**Substance-free** housing is offered in all three of our residence halls. This option is open to residents who have chosen to live a substance free life. The use and/or possession of tobacco, alcohol, or illegal substances is not permitted by the residents or their guests.

The **Community Governed Area** is a living option offered in East Wadsworth Hall to students who are 21 and over or entering their 3rd year of college. Students can assist in determining some policy guidelines, like quiet hours, through the development of a Community Living Agreement. An option for 5-meal plan and a monthly room and board payment plan is also available. Kitchen and laundry facilities are located in the area.

**Learning Communities** are unique residence hall living areas designed to enhance life at Michigan Tech by grouping students with a common interest together. Learning Communities blend programming with additional peer staff to help students achieve academic and personal success. For example, the **Computer Science Learning Community** (CSLC) is a group of students who share academic interests and are pursuing degrees in Computer Science, Computer Systems Science or Software Engineering. Together, these students explore computer science, share ideas, make friends, study for classes, and have some fun. Students are enrolled in the same four academic courses during the fall semester, which are tied to the computer science major and include a college success course. CSLC students live in a co-ed residential area on the third floor of East McNair Hall.

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

**I-HOUSE** (International House), located in McNair Hall, is a co-educational multicultural residential living and learning center designed to promote understanding among its residents from different nations and cultures. A resident assistant, program coordinator and a mentor plan and encourage residents to participate in the many educational and social activities on international and multicultural topics. The opportunity to live with students from different countries and cultures enhances the Michigan Tech experience. This area includes a kitchenette.

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

**Healthy Living**, located on the fifth floor of East McNair Hall, is designed to enhance opportunities for a well-rounded and healthy academic experience. Students who choose this option will have the opportunity to complete a wellness plan with the assistance of a mentor, participate in educational and social activities and are enrolled in the University course, Creating Your Success. The house is co-ed, substance-free, and open to new and returning residents.

**Dining Services**—All residents must choose a meal plan. First-year students may choose between the 19- and 14-meals per week plans. The 19-meal plan includes all meals offered and $90 Dining Dollars per year. The 14-meal plan includes up to 14 meals per week and $180 Dining Dollars per year. Dining Dollars allow students to eat at other times or places than at their own residence hall.
**Residence Life Staff**—Residence hall professional staff live in each hall and maintain regular office hours. They provide information, guidance and aid in dealing with academic or personal issues. Residents are encouraged to seek their assistance with any questions.

**Michigan Tech Apartments** [www.housing.mtu.edu](http://www.housing.mtu.edu)
The University maintains 348 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, cable and internet, 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 free washer and dryer.

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

**Off-Campus Housing** [www.aux.mtu.edu/usghousing/](http://www.aux.mtu.edu/usghousing/)
Many students choose to continue to live in residence halls beyond their first year, while others elect to live off campus in apartments, homes, or with Greek organizations. In order to assist those students interested in locating off-campus housing, Undergraduate Student Government (USG) maintains a list of off-campus householders renting to students, available from the USG Office, room 106, Memorial Union Building.

**Support Services**

**Career Center** [www.career.mtu.edu](http://www.career.mtu.edu)
The University Career Center is designed to meet the career planning, preparation and placement needs of all undergraduate and graduate students and alumni of Michigan Tech. Services include seminars, a one credit course, career fairs, a career resource center, individual advising, resume writing and critiquing, mock interviewing, on-campus interviewing, corporate speakers, and a career guidance software program. All services are free to Michigan Tech students and alumni.

Students are encouraged to visit the Career Center early in their academic career. By participating in co-op or summer internship work experience, learning interview skills, and being introduced to the corporate world, students will be well prepared for permanent employment upon graduation.

Students are also encouraged to attend on-campus job fairs sponsored semiannually by Michigan Tech. Job fairs represent one of the most effective opportunities for students to obtain co-op, summer internship, and permanent employment positions.

Visit the Career Center's website at [www.career.mtu.edu](http://www.career.mtu.edu) for a complete description of the numerous services and benefits that are available.

**Child Care** [http://www.mtu.edu/childcare/index.htm](http://www.mtu.edu/childcare/index.htm)
The newly opened Little Huskies Child Development Center, located on campus between the SDC tennis courts and the Forestry Complex on MacInnes Drive, 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 Little Huskies Child Development 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 center director Eva-Marie Hatfield at (906) 487-3528.

**Counseling Services** [www.counseling.mtu.edu](http://www.counseling.mtu.edu)
Counseling Services assists students with those social and personal/emotional issues that may interfere with the effective use of their talents as well as acquainting them with the opportunities available at Michigan Tech. Professional counselors are available in the Counseling Center, located on the main campus in the white house next to Fisher Hall. Confidential services are available for both individuals and groups.
Counseling helps students improve their emotional well-being by assisting in the development of decision-making skills, stress management skills, interpersonal communication skills, and self-awareness. Counseling assists students facing issues such as depression, pregnancy, anxiety, loneliness, substance abuse, or relationship problems.

International Programs and Services (IPS) [www.ips.mtu.edu](http://www.ips.mtu.edu)
The Office of International Programs and Services (IPS) is the key resource for international initiatives and programs at Michigan Tech. IPS offers information and services to students interested and involved in study abroad opportunities. IPS identifies foreign partner institutions and facilitates the development of student, faculty, and research international exchange agreements. In addition, the IPS serves as a home away from home for over 600 international students at Michigan Tech and provides visa and immigration counseling, advocacy and support services to them. Immigration and support services to international scholars on J-1 visa are also offered. IPS significantly contributes to the internationalization of Michigan Tech and Upper Peninsula communities by offering multiple cultural and educational programs. These include Intercultural Mentorship Program, International Film Festival, Parade of Nations, Festivals of the World, International Spouse Support Program, International Ambassador Program, Holidays Around the World, New International Student Orientation and informational workshops.

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

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

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

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

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

Information Technology (IT) [www.tc.mtu.edu](http://www.tc.mtu.edu) / [www.ets.mtu.edu](http://www.ets.mtu.edu)
IT provides the foundation for Michigan Tech's computing environment and manages the network, data, telephone, video, applications, and systems infrastructure needed to support the University's education, research, and community service missions. Specific academic computing resources are offered by individual schools and college departments. Campus and global network access from the residence halls (Resnet) are available through IT Customer Service. Other offerings include pager leasing, discounted off-campus ISP service, cable TV and movie channels, long distance service, and computer sales and service (including Apple Computer products), educational technology services for students including the Electronic Display System, video studios, audio-visual equipment, streaming media, and videoconferencing.

Student Affairs Office [www.studentaffairs.mtu.edu](http://www.studentaffairs.mtu.edu)
The Student Affairs Office provides support to students in co-curricular and extra-curricular 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  [www.lib.mtu.edu](http://www.lib.mtu.edu)
The J. Robert Van Pelt Library contains more than 800,000 volumes and regularly receives approximately 10,000 serials and periodicals. It is a designated depository for official foreign, U.S. government, and Michigan state documents, and for the U.S. Army Map Service. The library archives maintain an important collection of original materials concerning the history of the Keweenaw region, including the records of various copper mining companies.

A.E. Seaman Mineral Museum  [www.museum.mtu.edu](http://www.museum.mtu.edu)
Michigan Tech is home to one of the nation's premier collections of crystals, minerals, and ores. The A.E. Seaman Mineral Museum, the official "Mineralogical Museum of Michigan," contains more than 30,000 specimens, including the world's finest display from Michigan's copper and iron mining districts.
General Education

General Education Goals

www.admin.mtu.edu/admin/vpinst/gened.htm

General education goals, a required part of every Michigan Tech degree, include developing in each student

• fundamental scholastic habits of careful reading, communication, critical reasoning, balance, analysis and argument
• the ability to apply multiple disciplinary perspectives in interpretation, analysis, and creative problem solving
• respect for diversity and awareness of complex contexts of their study and their work
• knowledge of a broad range of topics and disciplines complementary to the major

The General Education curriculum is made up of the following requirements:

• Four core courses (13 semester credits)
• Fifteen semester credit distribution requirement (usually five courses)
• Science/mathematics courses (16 credits)
• Three semester units of co-curricular activities

General Education requirements are not normally waived, substituted or modified. Advisors may submit specific requests in special situations, such as when students have received incorrect advice. Requests are reviewed on an individual basis by the office of the Provost for the General Education Council.

Core Courses (13 credits)

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

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

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

General Education Options

1. Modern Language Option for World Cultures (UN1002) Two semesters of a single modern language taken at Michigan Tech along with UN 1003 World Cultures lab. UN1003 World Cultures lab is the one credit lab portion taken by students concurrently enrolled in modern language. Students may begin their two semesters of modern language in the fall or spring semesters of their first year. In the spring term students choosing this option must enroll concurrently in UN1003 World Cultures lab and a modern language. Students with transfer or AP language credit, or who plan to study abroad, should see the Humanities Department Modern Language Director for advice. The two semesters of language and UN1003 meet the requirement for UN1002 and 3 hours of distribution requirements.
2. **Distribution Course Option Study Abroad Students** General Education international transfer credit for study abroad courses (transfer credit from institutions outside the U.S) will be assigned by the International Programs and Services in the spirit of Michigan Tech distribution list requirements. It is understood that IPS will apply non-Michigan Tech courses to distribution based on their equivalence or congruence with existing general education distribution courses.

**General Education Transfer Credit**

1. After enrollment at Michigan Tech a student may **not** transfer in credits to meet UN 1001 and UN 1002.
2. Students may transfer into UN 2001 and UN 2002 even after enrollment at Michigan Tech but must see the Transfer Office **before** taking to verify they are taking the correct course.
Distribution Courses
2007-2008 Academic Year

UN1002, World Cultures, and UN2002, Institutions, serve as prerequisites for the 15-credit distribution requirement. The distribution courses are divided into two lists: World Cultures and Institutions.

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

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

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

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

World Cultures
(Prerequisite: UN1002)

<table>
<thead>
<tr>
<th>Code</th>
<th>Course Description</th>
<th>Credits</th>
</tr>
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<tbody>
<tr>
<td>AF2001</td>
<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>BA4780</td>
<td>International Business Communications</td>
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<tr>
<td>CM3410</td>
<td>Technical Communication for Chem. Engineering</td>
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</tr>
<tr>
<td>EC3020</td>
<td>History of Economic Thought</td>
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<tr>
<td>EH4100</td>
<td>Sports Psychology</td>
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<tr>
<td>ENT2962</td>
<td>Communication Contexts</td>
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<td>ENT3962</td>
<td>Communication Strategies</td>
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<td>ENT4952</td>
<td>Complex Communication Practices</td>
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<tr>
<td>FA2150</td>
<td>Creative Drawing (activities)*</td>
<td>3</td>
</tr>
<tr>
<td>FA2200</td>
<td>Watermedia I (activities)*</td>
<td>3</td>
</tr>
<tr>
<td>FA2300</td>
<td>Two-Dimensional Design*</td>
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</tr>
<tr>
<td>FA2305</td>
<td>Ceramics I (activities)</td>
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<tr>
<td>FA2330</td>
<td>Art Appreciation*</td>
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<tr>
<td>FA2430</td>
<td>R &amp; D Jazz Band (activities)*</td>
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<tr>
<td>FA2500</td>
<td>Music Theory I*</td>
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<td>FA2520</td>
<td>Music Appreciation*</td>
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<tr>
<td>FA2600</td>
<td>The Technique of Acting (activities)*</td>
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<td>FA2610</td>
<td>Acting II: Scene Study (activities)</td>
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<td>FA2660</td>
<td>Mainstage Theatre: Acting (activities)*</td>
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<td>FA2800</td>
<td>Script Analysis*</td>
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<td>FA2821</td>
<td>Performance Design Principles*</td>
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<td>Life Drawing (activities)</td>
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<td>FA3200</td>
<td>Watermedia II (activities)</td>
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<td>FA3300</td>
<td>Three-Dimensional Design</td>
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<td>Ceramics II (activities)</td>
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<td>Art History I</td>
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<td>Sculpture (activities)*</td>
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<td>Wind Symphony (activities)*</td>
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<td>Jazz Lab Band (activities)*</td>
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<td>Concert Choir (activities)*</td>
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<td>FA3530</td>
<td>Music Theory II</td>
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<tr>
<td>FA3550</td>
<td>History of Jazz</td>
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<tr>
<td>FA3560</td>
<td>Music History</td>
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<td>FA3670</td>
<td>Acting Ensemble (activities)*</td>
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<td>FA3700</td>
<td>Scenic Design</td>
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<td>FA3760</td>
<td>Costume Design</td>
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<td>FA3780</td>
<td>Directing for Theatre</td>
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<td>FA3810</td>
<td>Ancient Theatre History</td>
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<td>FA3821</td>
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<td>FA3830</td>
<td>American Musical Theatre</td>
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<td>FA4200</td>
<td>Advanced Watermedia Studio (activities)*</td>
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<td>Music Performance: Jazz (activities)*</td>
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<td>Jazz Arranging</td>
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<td>HU2110</td>
<td>Creative Writing*</td>
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(Prerequisite: UN2002)

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* Indicates course may be taken during the first year in the same term as Perspectives on Inquiry and/or World Cultures.
### General Education: Science and Mathematics
#### 2007-2008 Academic Year

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

**Note the following restrictions:**
1. At least 12 of the credits must be outside the student's major field of study.
2. Students must complete 4 credit hours in mathematics at 1000-level or higher and one laboratory science course. Requiring computer science or engineering is at the discretion of the department.
3. The distribution of the required 16 credits varies by curriculum. Some programs specify all 16 credits; others do not. For example, a computer science course may be a requirement for some departments but not others.
4. For curricula that do not specify mathematics and lab science requirements, students can meet these requirements by taking:
   a. 4 credits or more of Mathematics (MA) at the 1000-level or above
   b. any Biology (BL), Chemistry (CH), Forestry (FW) Geology (GE) or Physics (PH) course that is 3 credits or more and that also includes a lab component as a separate course or SS3220, Archaeological Sciences.

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<td>Computer Network &amp; System Administration (BS)</td>
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<td><strong>Interdisciplinary Certificates</strong></td>
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<td>Graduate Certificate in Sustainability</td>
<td>IGCS</td>
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<td>(Sustainable Futures Institute)</td>
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<td><strong>Department of Education – Teaching Certification</strong></td>
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<td><strong>Secondary Education-Teacher Cert Majors</strong></td>
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<td>Biological Sciences (Conc SBL7)</td>
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<tr>
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<td>Earth Science (Conc EGL2)</td>
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<td>Liberal Arts/English (Conc SHU3)</td>
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<td>Mathematics (Conc SMAT)</td>
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<td>Social Sciences (Conc SSS2)</td>
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<td>Teacher Education (Admissions Conc)</td>
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<td>Technology and Design (BS in Engineering)</td>
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<td>Integrated Science (BS in FES or Engineering)</td>
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<td>Technology and Design</td>
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<td><strong>Administrative Major Codes</strong></td>
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<tr>
<td>Educational Opportunities</td>
<td>PEO</td>
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<tr>
<td>English as a Second Language</td>
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<td>Non-Degree Grad</td>
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<td>Non-Degree Seeking</td>
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<td>Post-Teaching Certification</td>
<td>PTC</td>
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<tr>
<td><strong>Sponsored Educational Programs (Distance)</strong></td>
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<tr>
<td>Cook Industries (Conc)</td>
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<tr>
<td>Engineering-Manufacturing</td>
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<td>Ford (Conc)</td>
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<td>General Motors (Conc)</td>
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<td>Sponsored Educational Programs</td>
<td>USEP</td>
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Revised 7/13/06
Undergraduate Course Descriptions
Effective Fall 2007

Air Force ROTC

AF 0100 - Foundations of US Air Force I
Introduces students to the USAF and ROTC. Topics include Air Force mission, organization, 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 0200 - Basic Leadership
Introduces students to the USAF and ROTC. Topics include Air Force mission, organization, 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 0300 - Leadership Studies I
Study and practice of leadership in civilian and military organizations. Topics include leadership principles, problem solving, management fundamentals, counseling, motivation, mentoring, and effective communication. Various leadership theories are discussed. The course includes discussion, informal lecture, case studies, self-evaluation of leadership traits, and experiential exercises.

Credits: 3.0
Lec-Rec-Lab: (0-3-2)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisites: UN 2002

AF 0400 - National Security Affairs I
This course is designed to develop an understanding of the nature of conflict and how the United States military forces are developed, organized, and employed. Topics include the need for national security, the evolution and formulation of American defense policy and strategy, the origins of regional security issues, and joint doctrine.

Credits: 3.0
Lec-Rec-Lab: (0-3-2)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisites: UN 2002

AF 0500 - National Security Affairs II
Study of leadership in civilian and military institutions. Topics include officer opportunities, team building, feedback, Air Force evaluation systems, leadership ethics, professional relations, and communication skills. The course includes discussion, informal lecture, case studies, and experiential exercises.

Credits: 3.0
Lec-Rec-Lab: (0-3-2)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore

AF 0600 - Special Topics in Aerospace Studies
Read, conduct research, and prepare reports and presentations on aerospace studies topics under the guidance of a faculty member.

Credits: variable to 3.0; Repeatable to a Max of 3
Semesters Offered: Fall, Spring
Restrictions: Permission of instructor required

AF 1003 - Basic Leadership
Study of leadership in civilian and military institutions. Topics include officer opportunities, team building, feedback, Air Force evaluation systems, leadership ethics, professional relations, and communication skills. The course includes discussion, informal lecture, case studies, and experiential exercises.

Credits: 3.0
Lec-Rec-Lab: (0-3-2)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore

AF 1001 - Foundations of US Air Force I
Introduces students to the USAF and ROTC. Topics include Air Force mission and organization, officer opportunities, 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 1100 - Foundations of US Air Force II
Introduces students to the USAF and ROTC. Topics include Air Force mission, organization, officer opportunities, and communication skills. Leadership Laboratory is mandatory for AFROTC cadets and complements this course by providing cadets with followership experiences.

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

AF 1200 - Basic Aeronautics
Examines aircraft systems and instrumentation, aerodynamics, aircraft performance, VFR/IFR cross-country navigation techniques, and weather reports and forecasts. Includes the Federal Aviation Regulations and aviation physiology. At the end of this course, students will have received the aeronautical knowledge necessary for certification as a private pilot.

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

AF 1300 - Basic Aeronautics
Examines aircraft systems and instrumentation, aerodynamics, aircraft performance, VFR/IFR cross-country navigation techniques, and weather reports and forecasts. Includes the Federal Aviation Regulations and aviation physiology. At the end of this course, students will have received the aeronautical knowledge necessary for certification as a private pilot.

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

AF 1001 - History of US Air & Space Power I
This course examines the history of United States air and space power from the first balloons and dirigibles up to the Korean War through key events and personalities. The course looks at United States air and space power in the context of the international political scene in war and peace. The role of women and minorities in the evolution of United States air and space power is highlighted.

Credits: 1.0
Lec-Rec-Lab: (0-1-2)
Semesters Offered: Fall
Pre-Requisites: UN 1002 or UN 1003

AF 1002 - History of US Air & Space Power II
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
Pre-Requisites: UN 1002 or UN 1003

AF 1003 - Basic Leadership
Overview of leadership fundamentals: problem solving, goal setting, listening skills, providing feedback and effective oral and written communication. Students explore dimensions of leadership values, attributes, skills, and actions in the context of practical hands-on interactive exercises.

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

AF 1004 - National Security Affairs I
This course is designed to develop an understanding of the nature of conflict and how the United States military forces are developed, organized, and employed. Topics include the need for national security, the evolution and formulation of American defense policy and strategy, the origins of regional security issues, and joint doctrine.

Credits: 3.0
Lec-Rec-Lab: (0-3-2)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisites: UN 2002

AF 1005 - National Security Affairs II
Study of leadership in civilian and military institutions. Topics include officer opportunities, team building, feedback, Air Force evaluation systems, leadership ethics, professional relations, and communication skills. The course includes discussion, informal lecture, case studies, and experiential exercises.

Credits: 3.0
Lec-Rec-Lab: (0-3-2)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore

AF 1006 - Special Topics in Aerospace Studies
Read, conduct research, and prepare reports and presentations on aerospace studies topics under the guidance of a faculty member.

Credits: variable to 3.0; Repeatable to a Max of 3
Semesters Offered: Fall, Spring
Restrictions: Permission of instructor required

AF 1007 - National Security Affairs I
This course is designed to develop an understanding of the nature of conflict and how the United States military forces are developed, organized, and employed. Topics include the need for national security, the evolution and formulation of American defense policy and strategy, the origins of regional security issues, and joint doctrine.

Credits: 3.0
Lec-Rec-Lab: (0-3-2)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisites: UN 2002

AF 1008 - National Security Affairs II
Study of leadership in civilian and military institutions. Topics include officer opportunities, team building, feedback, Air Force evaluation systems, leadership ethics, professional relations, and communication skills. The course includes discussion, informal lecture, case studies, and experiential exercises.

Credits: 3.0
Lec-Rec-Lab: (0-3-2)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore

Army ROTC

AR 1001 - Foundations of Office Practice
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, office practice, and the Army profession.

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

AR 1002 - Basic Leadership
Overview of leadership fundamentals: problem solving, goal setting, listening skills, providing feedback and effective oral and written communication. Students explore dimensions of leadership values, attributes, skills, and actions in the context of practical hands-on interactive exercises.

Credits: 1.0
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Spring
AR 1011 - Basic Leadership Lab I
Hands-on practice of basic military skills, including basic first-aid, weapons familiarization, orienteering, individual and squad level tactics, techniques and procedures.
Credits: 1.0
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall

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

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

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

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

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

AR 2068 - Fall Military Physical Conditioning
Develops physical fitness, personal confidence, self-esteem and military skills. Students are exposed to both individual and group physical fitness procedures and techniques. Emphasis is on developing a good fitness program for each individual student. May 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

AR 2069 - Spring Military Physical Conditioning
Develops physical fitness, personal confidence, self-esteem and military skills. Students are exposed to both individual and group physical fitness procedures and techniques. Emphasis is on developing a good fitness program for each individual student. May 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: Spring

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

AR 3002 - Tactical Leadership
Uses intense situational leadership challenges to build cadet skills in leading small units. Skills in decision-making, persuading, and motivating team members are explored, evaluated, and developed. Emphasis is also placed on developing and issuing operations orders.
Credits: variable to 3.0
Semesters Offered: Spring
Co-Requisite(s): AR 3012
Pre-Requisite(s): AR 3001

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

AR 3012 - Advanced Leadership Lab II
Hands-on practice of basic military skills, including squad and platoon leadership, basic first-aid, weapons familiarization, orienteering, showshoeing, cold weather survival skills, and individual, squad and platoon level tactics, techniques and procedures.
Credits: 1.0
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Spring
Co-Requisite(s): AR 3002
Pre-Requisite(s): AR 3011

AR 3014 - Airborne School
Three week course taught at the U.S. Army Airborne School teaches students the basic techniques of parachuting. Course is very physically and mentally demanding, requiring cadets to be in excellent physical condition to attend and successfully complete the course. May be used once as a general education co-curricular course.
Credits: 1.0; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Summer
Restrictions: Permission of department required
Pre-Requisite(s): AR 1001 or AR 1002

AR 3068 - Military Physical Leadership I
Develops a cadet's leadership abilities to design, implement, and assess a platoon level Army physical training program. Cadets learn the basic leadership of designing and developing a physical conditioning program. May 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-Requisite(s): AR 2068 and AR 2069

AR 3069 - Military Physical Leadership II
Develops a cadet's leadership abilities to design, implement, and assess a platoon level Army physical training program. Cadets improve their small group's level of physical conditioning while honing their own leadership skills. May 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: Spring
Restrictions: Permission of department required; May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): AR 3068

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

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

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

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

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

Business

BA 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

BA 1200 - IS/IT Fundamentals
Covers basic concepts underlying information technology. Introduces systems concepts, information technology, application software, and programming using an industry standard programming language. Introduces information use in organizations and how information technology enables improvements in the quality and timeliness of information.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring, Summer

BA 2100 - Business Statistics
Introduction to basic concepts and methods of probability and statistics, including the following topics: collection, description and presentation of data, probability, random variables, sampling, probability distributions, estimation and hypothesis testing, ANOVA, and selected non-parametric techniques.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring, Summer
Pre-Requisite(s): MA 1135 or MA 1140 or MA 1160 or MA 1161

BA 2110 - Quantitative Problem Solving
Stresses development of quantitative decision and analysis skills to solve problems with cases, exercises, simulations, and mathematical modeling. Topics include regression analysis, decision analysis, stochastic environments, data sources and errors, utility theory risk preference, linear programming, and simulation analysis.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring, Summer
Pre-Requisite(s): BA 2100 or MA 2710 or MA 2720 or MA 3710

BA 2200 - Business Programming Concepts
Develops business problem solving skills through the application of a commonly used high-level business programming language. Topics include the nature of the business programming environment, fundamentals of the language (e.g., programming constructs, data management, manipulation of simple data structures), structured programming concepts, desirable programming practices and design, debugging and testing techniques.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Pre-Requisite(s): BA 1200

BA 2210 - Web Application Development
Covers development technologies, tools, and environments of web-enabled and e-commerce business solutions. Topics include the nature of the development environment for web-based solutions, fundamentals of development technologies, desirable development practices, and design, debugging, and testing methods.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): BA 2200 or CS 1121 or CS 1151

BA 2310 - Accounting Principles II
Emphasizes the role of accounting information within a firm. Topics include budgeting, responsibility accounting, cost allocations, cost behavior, decision models, capital budgeting, and an introduction to product costing in manufacturing and service sector firms.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring, Summer
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): BA 2300

BA 2330 - Accounting I
Basic introduction to the principles, concepts, theories and practices underlying financial reporting; an introduction to managerial accounting concepts, theories and practices including product and service costing, budgeting, capital investments and the uses of accounting information for planning and controlling operations.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring, Summer
Restrictions: May not be enrolled in one of the following Class(es): Freshman

BA 2340 - Accounting II
Examination of principles, concepts and theories underlying the valuation of financial statement elements and the examination of managerial accounting concepts, theories and practices routinely used to support decision making within organizations.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring, Summer
Pre-Requisite(s): BA 2330

BA 2500 - Business Law I
Provides an understanding of the legal basis of contracts and their enforcement in the areas of general contracts, contracts of commercial sales and of agency, and commercial paper.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring, Summer

BA 2700 - Business Problem Solving
Develops individual and group problem-solving skills using active, hands-on learning. Emphasizes problem identification and problem solution under conditions of ambiguity and uncertainty. Stresses creativity, interpersonal skills and skill assessment, communication, group process and teamwork, and action planning.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring, Summer
Restrictions: May not be enrolled in one of the following Class(es): Freshman

BA 3200 - IS/IT Management
Focuses on the theory and application of the information-systems discipline to organizations and roles of management, users, and information systems professionals. Covers the role of telecommunications and distributed systems for business, the use of information and its implications for decision support in organizations, and the ethical, legal, and social issues of IT.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring, Summer
Pre-Requisite(s): BA 1200 or CS 1121 or CS 1131 or ENG 1101 or SAT 1610

BA 3210 - Business Database Management
Emphasizes database principles that are constant across different database software products through concrete examples using a relational database management system. Provides a well-rounded business perspective about developing, utilizing, and managing organizational databases.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): BA 3200(C) and (BA 2200 or CS 1121 or CS 1131 or CS 1122)

Undergraduate Course Descriptions, 2007-08, Page 3 of 86
BA 3220 - Systems Analysis and Design
Provides an understanding of the IS development and modification process and the evaluation choices of a system development methodology. Emphasizes effective communication with users and team members and others associated with the development and maintenance of the information system. Stresses analysis and logical design of departmental-level information system.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): BA 3210

BA 3250 - Telecommunications
Introduces students to telecommunications concepts, architectures and protocols, commercial offerings, hardware, software, network design, and telecommunications management, regulations, and business applications (e-commerce).
Credits: 3.0
Semesters Offered: Spring
Pre-Requisite(s): BA 3200(C)

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

BA 3290 - IS/IT Topics
Examines current IS/IT topics and issues in greater depth from a managerial perspective. A single offering of this course will concentrate on one or two topics, which will vary.
Credits: 3.0; Repeatable to a Max of 6
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Pre-Requisite(s): BA 3200

BA 3300 - Accounting Theory/Practice I
Studies the theory, concepts, and practices underlying financial reporting and measurement. Primary focus is on income measurement, and the valuation of assets, like cash, receivables, inventory, and long-lived assets, as well as multinational issues.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Pre-Requisite(s): BA 2310

BA 3310 - Accounting Theory/Practice II
A continuation of BA3300 with theories, concepts, and practices underlying financial measurement and reporting. Focuses on the measurement and reporting of liabilities and equities, and includes multinational issues.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Pre-Requisite(s): BA 3300 and BA 3400(C)

BA 3320 - Managerial/Cost Accounting I
The primary emphasis is on traditional and contemporary product costing techniques, cost allocation practices, and basic cost-management issues. Topics include process costing, standard costing, activity-based costing, backflush costing, cost allocation issues, balanced scorecard, strategic profitability analysis, and the role of accounting in contemporary management practices.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Pre-Requisite(s): BA 2310

BA 3400 - Principles of Finance
Introduction to the principles of finance. Topics include financial mathematics, capital acquisition, the capital investment decision, financial assets valuation, and working capital management
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring, Summer
Pre-Requisite(s): BA 3240(C) or BA 2310 and (BA 2100 or MA 2710 or MA 2720 or MA 3710)

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

BA 3600 - Quality Management
Current quality control and management philosophy, concepts, and tools: strategic importance, philosophies of leading sages, practices (including ISO9000 standards and Baldrige award requirements), process-focused and result-focused tools as well as statistical process control.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: On Demand
Pre-Requisite(s): BA 2100 or MA 2710 or MA 2720 or MA 3710

BA 3610 - Operations Management
Fundamental principles of operations and service management; includes strategic importance and relevant interrelated concepts and tools in product/process design, work systems, forecasting, inventory and materials management, just-in-time, scheduling, capacity management, and maintenance management.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring, Summer
Pre-Requisite(s): BA 2100 or MA 2710 or MA 2720 or MA 3710

BA 3620 - Project Management
Focuses on application of systems analysis to project definition and selection. Covers project teams, their structures, and interactions; cross-functional communication in technological project management; project management planning, scheduling, and control tools; project monitoring, evaluation, and termination; multiple project management and inter-project relations. Case study of new product process development. Requires case study reports.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Pre-Requisite(s): BA 3200

BA 3650 - Intellectual Property Law, Technology, Society and Innovation
Principles of intellectual property law, addressing legal and contemporary policy issues in copyright, trademark and patent and how the law impacts the balance between property protections, technological innovation and public access. Emphasizes learning through lectures, case studies, and simulations.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Pre-Requisite(s): BA 3280

BA 3700 - Organizational Behavior
Covers concepts of human relations and organizational behavior through the study of people's behavior at work. Develop understanding, attitudes, and skills leading to increased personal effectiveness.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Pre-Requisite(s): BA 3200

BA 3780 - Entrepreneurship
Covers management issues associated with establishing a successful new enterprises as a small businesses or part of an existing firm. Create a business plan. Case studies develop understanding of opportunity recognition, entrepreneurial teams, reward systems, financing alternatives, family ventures, ethical and legal contractual considerations, and resource needs.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Pre-Requisite(s): On Demand

BA 3790 - Business Communication
Emphasizes written reports and oral presentation skills needed for effective communication. Examines technologies supporting written and oral communication in the workplace, along with ethical and international considerations.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Pre-Requisite(s): BA 3200

BA 3900 - Undergraduate Internship
Practicum for students pursuing an under-graduate degree in IS/IT to gain hands-on experience in a professional setting.
Credits: 1.0
Pre-Requisite(s): BA 3200 or BA 2100

Undergraduate Course Descriptions, 2007-08, Page 4 of 86
BA 3800 - Principles of Marketing
Emphasizes decisions made in developing both strategic and tactical marketing plans. Uses computer simulations, experiential learning assignments, and marketing plan development to demonstrate principles of market segmentation, product development, pricing, distribution planning, and promotion.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring, Summer
Restrictions: May not be enrolled in one of the following Class(es): Freshman

BA 3900 - Business Internship
A practical approach to business problem solving. Requires a report on work activity upon completion of the internship.
Credits: variable to 4.0; Repeatable to a Max of 4
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of instructor required; Must be enrolled in one of the following College(s): School of Business & Economics

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

BA 4210 - Advanced Information Systems
Focuses on understanding IT for competitive advantage and as an agent of transformation. Topics include managing IT infrastructure and architecture, facilitating information distribution throughout the enterprise, conducting case analyses to develop a framework for innovative Enterprise Systems to be used for sustainable competitive advantage.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Major(s): Business Administration; Must be enrolled in one of the following Class(es): Senior
Pre-Requisite(s): BA 3220 and (BA 3250(C) or BA 4200)

BA 4250 - Information Systems Projects
MIS capstone course. Previous completion of MIS electives and BSBA technology corequisite required. Applies IS concepts as solutions to business problems using project teams and faculty project manager supervision. Emphasizes the latter portion of the systems development life cycle project management within an IS context.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Major(s): Business Administration; Must be enrolled in one of the following Class(es): Senior
Pre-Requisite(s): BA 3220 and (BA 3250(C) or BA 4200) and BA 2200

BA 4300 - Attestation and Assurance
Auditing procedures and techniques associated with public accounting and with internal auditing for business entities. Topics include auditor's responsibilities, professional ethics, generally accepted auditing standards, purpose and types of audits, objectives, internal control, evidence, organization within the public accounting profession, the audit program, and auditing procedures and techniques.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Class(es): Senior
Pre-Requisite(s): BA 3310(C) and BA 3300

BA 4310 - Foundations of Taxation
Introduction to basic principles, concepts, and theoretical framework of taxation systems, emphasizing income taxation and its impact on decision making. Topics include tax planning and compliance for individuals, corporations, and partnerships.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Sophomore
Pre-Requisite(s): BA 2310

BA 4320 - Managerial/Cost Accounting II
Emphasizes information requirements of contemporary management decision-making and strategic-planning processes. Covers contemporary control and evaluation practices (such as activity-based management), determining the costs of quality, and productivity analysis in the context of accounting information systems.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Class(es): Sophomore
Pre-Requisite(s): BA 3320

BA 4350 - Advanced Tax Topics
Continuation of BA4310. Introduction to advanced principles and concepts of taxation, emphasizing income taxation and its impact on decision making. Topics include tax planning and compliance for estates and trusts, gratuitous transfers, multi-jurisdictional operations, and entity formations, liquidations, and reorganizations.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): BA 4310

BA 4360 - Accounting Systems
Introduction to the basic principles, concepts, and theoretical framework for the design and operation of accounting information systems, emphasizing its use to enhance decision making. Topics include system design, internal controls, the use of databases, and electronic commerce.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): BA 2310

BA 4370 - Advanced and Governmental Accounting
Advanced measurement and financial reporting problems encountered by accountants. Topics include the Statement of Cash Flows, consolidations and mergers, partnerships, governmental and not-for-profit organizations, and foreign operations.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): BA 3310

BA 4380 - Accounting Theory
Analysis and evaluation of contemporary accounting thought. Explores current topics through readings, independent research, and discussions. Emphasizes concepts rather than procedures.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Pre-Requisite(s): BA 4370

BA 4400 - Investment Analysis
Operations of the stock market, bond market, and other financial markets. Stock and bond valuation techniques, financial markets and institutions, and investment opportunities.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Pre-Requisite(s): BA 3400 or EC 3400

BA 4410 - Advanced Financial Management
Advanced topics in managerial finance: working capital management, capital budgeting, investment analysis, portfolio theory, and other topics. Includes case studies, class discussion, use of the computer in financial modeling, and other financial applications.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): BA 3400

BA 4450 - Special Topics in Finance
Examines current issues in Finance and other topics of interest to faculty and students in greater depth.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: On Demand
Restrictions: Permission of instructor required
Pre-Requisite(s): BA 3400 or EC 3400

BA 4460 - Derivatives and Financial Engineering
Covers the pricing and use of options, financial futures, swaps, and other derivative securities.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): BA 3400

BA 4470 - Applied Portfolio Management
Covers issues in the management and administration of investments in an institutional setting. Students manage a real portfolio of financial assets.
Credits: variable to 3.0; Repeatable to a Max of 6
Semesters Offered: Fall, Spring
Restrictions: Permission of instructor required; May not be enrolled in one of the following Class(es): Freshman, Sophomore
BA 4480 - Global Finance
Studies international financial systems and markets. Covers the principle of comparative advantage, balance of payments, exchange rate systems, theories of international finance, identification of international risk exposures, the management and treatment of risk, and special topics of international finance.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2001-2002 academic year
Pre-Requisite(s): BA 3400

BA 4490 - Personal Financial Planning
Provides students with an overview of personal financial issues and services and instruments offered by economic and financial institutions. Topics include the personal financial environment, employee compensation, personal investments and asset management, tax planning, the development of an adequate but cost-effective insurance program, and retirement planning.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): BA 3400 or EC 3400

BA 4600 - Management of Technology and Innovation
An evolutionary process perspective will be taken viewing how technology strategy evolves from underlying technology competences and capabilities, understanding patterns of technological innovations, development of technological capabilities and competences, the role of collaboration in innovation, and profiting from new technologies.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring
Restrictions: Must be enrolled in one of the following Class(es): Senior
Pre-Requisite(s): BA 4480, BA 4630, BA 4640, BA 4650, BA 4660

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

BA 4630 - Operations Strategy
Addresses issues in operations management, quality, finance/accounting, marketing, supply chain, and technology to provide an interdisciplinary focus on strategic planning for operations. Also addresses issues associated with global initiatives and changing technology.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand - Offered alternate years beginning with the 2002-2003 academic year
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): BA 4610

BA 4650 - International Technology Management
Comparative international studies of economic and managerial aspects of technological innovation. Analyzes conditions, forms, and structures of management for international technological projects. Case studies of International transfer of technology. Two credits without a research report; three credits with a research report.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): BA 4600(C)

BA 4680 - Systems Thinking and Dynamic Modeling
Systems thinking concepts are applied to understand the complex feedback relationships that exist within a dynamic system. Uses computer-based simulators and a laboratory for experimentation to understand the side effects of proposed policies and trade-offs between short-term and long-term impacts.
Credits: 3.0
Lec-Rec-Lab: (3-0-3)
Semesters Offered: On Demand - Offered alternate years beginning with the 2001-2002 academic year
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): UN 2002

BA 4700 - Strategic Management
Introduction to strategy content (e.g., differentiation, diversification, and strategic alliances) and strategizing processes (e.g., decision-making and restructuring). The course emphasizes strategies and strategizing processes within technological firms.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring
Restrictions: Must be enrolled in one of the following College(s): School of Business & Economics; Must be enrolled in one of the following Class(es): Senior
Pre-Requisite(s): BA 3200 and BA 3400 and BA 3610 and BA 3700 and BA 3800

BA 4710 - International Management
Study of managing work in a global context. Assesses impact of culture and the international environment (economic, social, legal, technological) on management, personnel, marketing, accounting, and finance strategies. Examines international business structures from licensing to joint ventures. Develops attitudes and skills leading to increased international effectiveness.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior
Pre-Requisite(s): BA 3700 and EC 3100(C)

BA 4740 - Special Topics in Management
Examines additional management topics and issues in greater depth. A single offering of this course will concentrate on one or two topics which vary.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: On Demand
Restrictions: Permission of instructor required
Pre-Requisite(s): BA 3700

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

BA 4770 - Human Resource Management
Examines methods that organizations use to meet organizational goals through influencing worker attitudes, behaviors, and performance. Topics include recruitment, selection, training, performance appraisal, and compensation.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): BA 3700

BA 4780 - International Business Communications
Study of managing work in a global context. Assesses impact of culture and the international environment (economic, social, legal, technological) on management, personnel, marketing, accounting, and finance strategies. Examines international business structures from licensing to joint ventures. Develops attitudes and skills leading to increased international effectiveness.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior
Pre-Requisite(s): BA 3700

BA 4790 - Ecological Sustainability and Organizations
Examines the problems and solutions associated with creating and maintaining ecologically sustainable organizations (primarily businesses). Builds an ethical framework using concepts of ecological identity and place and examines the principles of ecological economics and sustainable development.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): UN 1001 and (UN 1002 or UN 1003) and UN 2001 and UN 2002
BA 4800 - Business Research
Focuses on research to help make better business decisions. Includes the study of qualitative and quantitative research methods, survey research methodology, potential sources of error, statistical analysis, and using SPSS. Cases or practical research are used to give experience in business research methods.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): (BA 2100 or MA 2710 or MA 2720 or MA 3710) and BA 3800

BA 4840 - Industrial Marketing
Focuses on marketing and purchasing of goods and services in industrial markets. Includes pricing issues, distribution, product planning and value analysis, inventory management, and legal issues. Examines the implications of these issues to industrial buyers and industrial marketers.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): BA 3800

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

BA 4870 - Advertising/Sales Promotion
Studies how advertising and sales promotion campaigns (for both consumer and industrial goods) are created, produced, distributed, and measured. Emphasizes roles played by clients, various components of advertising agencies, and media companies. Focuses on experiential learning using group projects for real clients (often a nonprofit).
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Pre-Requisite(s): BA 3800

BA 4880 - Sales and Sales Management
Looks at the role of the selling function as an integral part of the total marketing effort. Examines the administrative functions of sales management, the dynamics of the buying-selling process, and sales strategies and tactics.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring
Pre-Requisite(s): BA 3800

BA 4900 - Research and Special Projects
Under the general guidance of a faculty member, students read, conduct research, and prepare reports and papers as required. The SBE's Curriculum Committee must approve the subject of the proposed project.
Credits: variable to 4.0; Repeatable to a Max of 6
Semesters Offered: On Demand
Restrictions: Permission of instructor and department required; May not be enrolled in one of the following Class(es): Freshman, Sophomore

BA 4950 - CenTILE Project
Students work on a consulting oriented team project under the guidance of a faculty advisor. The team collaborates with a client to analyze a problem, develop a project plan, summarize findings, and make recommendations.
Credits: variable to 4.0; Repeatable to a Max of 6
Semesters Offered: On Demand
Restrictions: Permission of instructor required

BA 4990 - Special Topics in Business
Business topics of interest to students and faculty.
Credits: variable to 4.0; Repeatable to a Max of 6
Semesters Offered: On Demand
Restrictions: Permission of instructor required; May not be enrolled in one of the following Class(es): Freshman, Sophomore

BE 2100 - Undergraduate Biomedical Engineering Seminar
An overview of biomedical engineering designed especially for freshmen and sophomores that includes presentations by faculty, members of the community and other guest lecturers. Topics ranging from clinical engineering through basic biomedical engineering research are covered.
Credits: 1.0
Lec-Rec-Lab: (1-0-0)
Semesters Offered: Fall
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: Fall, Summer
Pre-Requisite(s): MA 1135 or MA 1160

BE 2400 - Biology for Engineers I
General principles and engineering applications of science and biology, including cell biology, physiology, molecular biology, genetics, and biotechnology.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Level(s): Graduate; May not be enrolled in one of the following Class(es): Junior, Senior

BE 2500 - Introduction to Biostatistics
Topics include collection of data, presentation of data, statistical inference, causality, basic probability, basic epidemiology, design of clinical trials, regulation in the health industry, and an overview of the health science research culture.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: On Demand
Pre-Requisite(s): MA 1020 or MA 1032

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

BE 3500 - Biomedical Materials
An overview of biomaterials in three basic classes: metals, ceramics, and polymers. Topics include biomaterials used in special medical applications (such as tissue replacement, absorbable and non-absorbable sutures, and soft tissue replacements) as well as discussion of tissue, body, and blood response to implants (bio-compatibility).
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Pre-Requisite(s): (BL 1040 or BL 2400) and MY 2100 and (MEEM 2150(C) or ENG 2120(C))

BE 3600 - Biomedical Instrumentation
Introduction to theory of measurement and analysis from biological systems. Covers the use of transducers, data recording and analysis systems and signal processing techniques. Laboratory includes measurements of physiological quantities from living systems.
Credits: 4.0
Lec-Rec-Lab: (3-0-2)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Major(s): Biomedical Engineering
Pre-Requisite(s): EE 3010 and BL 2020 and BL 2021

BE 3750 - Human Biomechanics
Introduction to the analysis of anatomical structures, movements, and mechanics of the musculoskeletal system, including properties and strength of materials. Includes application of Newtonian mechanics, statics, and strength of materials of bone, muscle, tendon, and other biologic materials.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring
Restrictions: Must be enrolled in one of the following Major(s): Biomedical Engineering
Pre-Requisite(s): BL 2100 and (MEEM 2150 or ENG 2120)

BE 4000 - Independent Study
Students undertake an independent study under the guidance of a Biomedical Engineering faculty member. The course of study may either be research or academic and is decided upon between the study and faculty member.
Credits: variable to 6.0; Repeatable to a Max of 12
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of instructor and department required
BE 4100 - Cell and Tissue Mechanics
Focuses on mechanical behavior and 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: Spring
Pre-Requisite(s): BE 3750

BE 4110 - Neuroengineering
Brief overview of neuroanatomy, neurophysiology, and neurobiology followed by introductions of more advanced topics including neural tissue engineering, neural/electrode interfaces, and functional electrical stimulation.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Pre-Requisite(s): BE 2400 and BE 3500

BE 4200 - Biology for Engineers II
Covers, at an advanced level, the general principles and engineering applications of science and biology, including cell biology, physiology, molecular biology, genetics, and biotechnology.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: On Demand
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): BE 2400

BE 4300 - Advanced Polymeric Biomaterials
A specialized study of polymers used in biomedical engineering. Topics include: processing-structure-properties relationships for polymers, polymer fibers and composites, degradation of polymers, and medical applications for polymeric biomaterials.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: On Demand
Pre-Requisite(s): BE 3750

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

BE 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)
Restricions: May not be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): BL 2020 or BE 2400

BE 4600 - 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 instrumentation.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: On Demand
Pre-Requisite(s): BE 3600

BE 4700 - Biosensors: Fabrication & Applications
This course introduces the student to the fundamentals of biosensor development and applications. It provides an understanding of biological components, immobilization methods, transducers, and fabrication techniques.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: On Demand
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
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: On Demand

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
Pre-Requisite(s): BE 3600 and BE 3750 and BE 3500(C)

BE 4901 - Biomedical Design Project I
Team approach is used to resolve a defined problem in biomedical engineering. Projects are selected and undertaken with faculty guidance and sponsor input. Must be senior project ready, as defined by major, substitutes for prerequisites.
Credits: 2.0
Lec-Rec-Lab: (0-1-3)
Semesters Offered: Fall
Pre-Requisite(s): BE 3600(C) and BE 3600 and BE 3750

BE 4910 - Biomedical Design Project II
Continuation of Biomedical Design Project I (BE4901) under faculty guidance. Emphasizes design and testing of prototypes. Requires work project notebooks, oral and written reports, and presentations.
Credits: 3.0
Lec-Rec-Lab: (0-1-6)
Semesters Offered: Spring
Pre-Requisite(s): BE 4900

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

BE 4940 - Introduction to Tissue Engineering
Explores the application of engineering principles toward the construction/reconstruction of human tissue. Fundamental biological principles involved in tissue engineering are reviewed from an engineering perspective with examples of engineered tissues such as blood vessels, skin, liver, cartilage and bone.
Credits: 1.0
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Spring
Pre-Requisite(s): BL 1040 or BE 2400

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
Pre-Requisite(s): BL 1040 or BL 2400

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
Pre-Requisite(s): BE 3600

### Undergraduate Course Descriptions, 2007-08, Page 9 of 86

**BL 1020 - General Biology II**  
Discussion of the major principles by which life is organized. Topics include scientific methods, biological chemistry, cell structure and organization, multicellular organization, diversity of organisms, energetics and photosynthesis, cellular reproduction genetics, gene structure and expression, and recombinant DNA.  
**Credits:** 4.0  
**Lec-Rec-Lab:** (3-0-3)  
**Semesters Offered:** Spring  
**Restrictions:** Must be enrolled in one of the following Major(s): Biological Sciences, Clinical Laboratory Science  
**Pre-Requisite(s):** BL 1010

**BL 1040 - Principles of Biology**  
Basic principles through which biological systems operate. Topics include cell biology, structure, and function, energy production, genetics, physiology, diversity, evolution, and ecology.  
**Credits:** 4.0  
**Lec-Rec-Lab:** (3-0-2)  
**Semesters Offered:** Fall, Summer  
**Restrictions:** May not be enrolled in one of the following Major(s): Biological Sciences, Clinical Laboratory Science

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

**BL 1600 - Introduction to Biological Sciences**  
Introduction to fields and career opportunities in the biological sciences.  
**Credits:** 1.0; Graded Pass/Fail Only  
**Lec-Rec-Lab:** (0-1-0)  
**Semesters Offered:** Fall

**BL 1710 - Medical Terminology**  
Autotutorial course covers the fundamentals of medical terminology, including recognition and use of common prefixes, roots, and suffixes, as well as single-syllable words. Exercises also include spelling and pronunciation.  
**Credits:** 1.0  
**Lec-Rec-Lab:** (0-1-0)  
**Semesters Offered:** Fall

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

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

**BL 2010 - Anatomy & Physiology I**  
Comprehensive introductory course in vertebrate anatomy and physiology with emphasis on the human body. Interrelates structure with function in regard to maintaining homeostasis and normal functioning of the body. Covers the integument, skeletal system, nervous system, muscles, and the endocrine system.  
**Credits:** 3.0  
**Lec-Rec-Lab:** (3-0-0)  
**Semesters Offered:** Fall  
**Pre-Requisite(s):** CH 1110 or CH 1100

**BL 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 2101 - Anatomy & Physiology I Lab**  
The laboratory to accompany BL2101. Examines embryology, muscle and skeletal anatomy, and neuroanatomy. Explores the physiology of the nervous system, including vision and reflexes and muscle physiology. A student-designed lab project is used to teach experimental design.  
**Credits:** 1.0  
**Lec-Rec-Lab:** (0-0-3)  
**Semesters Offered:** Fall  
**Pre-Requisite(s):** BL 2101(C)

**BL 2100 - Principles of Biochemistry**  
Introductory overview to biochemistry. Topics include the biochemistry of amino acids, proteins, coenzymes, carbohydrates, nucleotides, nucleic acids, lipids, and water, as well as bioenergetics and photosynthesis.  
**Credits:** 3.0  
**Lec-Rec-Lab:** (3-0-0)  
**Semesters Offered:** Fall, Summer  
**Pre-Requisite(s):** (BL 1040 or BL 1020 or BE 2400) and (CH 1110 or CH 1100)

**BL 2160 - Botany**  
Covers structure, function, reproduction, and classification of plants and algae, relating these current ecological, agricultural, or other human issues.  
**Credits:** 4.0  
**Lec-Rec-Lab:** (3-0-3)  
**Semesters Offered:** Spring

**BL 2170 - Zoology**  
A discussion of the biology of animals, including the origins and evolution of the metazoan phyla, their physiology, development, ecology, behavior, natural history, and systematics. Emphasizes invertebrates other than insects.  
**Credits:** 4.0  
**Lec-Rec-Lab:** (3-0-3)  
**Semesters Offered:** Fall  
**Pre-Requisite(s):** BL 1010 or BL 1040

**BL 2200 - Genetics**  
A study of classical and molecular genetics. Topics include one- and two-locus genetics, recombination, gene structure, regulation and function, quantitative and population genetics, and genetic engineering. Covers both prokaryotes and eukaryotes.  
**Credits:** 3.0  
**Lec-Rec-Lab:** (3-0-0)  
**Semesters Offered:** Spring  
**Pre-Requisite(s):** (BL 1020 or BL 1040) and (BL 2100 or CH 4710)

**BL 2210 - Genetics Laboratory**  
A laboratory to complement BL2200. Covers applications of techniques used in genetics, including Mendelian analysis, tetrad analysis, karyotyping, DNA and protein electrophoresis, DNA and plasmid purification, transformation and restriction mapping, and PCR amplification of DNA.  
**Credits:** 1.0  
**Lec-Rec-Lab:** (0-0-3)  
**Semesters Offered:** Fall  
**Pre-Requisite(s):** BL 2200(C)

**BL 2310 - Molecular Biology Computational Lab**  
Use of computational tools to analyze molecular biology. Applications in medicine, agriculture and biotechnology.  
**Credits:** 1.0  
**Lec-Rec-Lab:** (0-0-3)  
**Semesters Offered:** Spring  
**Pre-Requisite(s):** BL 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): Biological Sciences, Clinical Laboratory Science; May not be enrolled in one of the following Class(es): Freshman  
**Pre-Requisite(s):** BL 1020 and BL 1710
BL 2940 - Human Nutrition
Covers basic and applied chemistry and biology of human nutrition. Includes practical information on planning and adopting a healthy diet as well as maintaining acceptable weight. Emphasizes social, global, and environmental issues pertinent to use of the world food supply.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): UN 2002
BL 3070 - Biology & Occupational Hygiene
The first third of this course will cover fundamentals of cellular and organismal biology. The remainder of the course covers the toxic effects of occupational chemicals, energy forms and industrial pollutants on human tissue. Emphasizes recognition, evaluation, and control of health hazards in the workplace.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): CH 1140 or CH 2400 or (CH 2410 and CH 2420)
BL 3190 - Evolution
A study of the patterns and processes of organic evolution. Topics include genetics of populations, mechanisms of deterministic and stochastic genetic change, history of life on earth, biogeography, molecular evolution, units of selection, sexual selection, speciation, and human evolution.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): BL 1710 and BL 2410
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: Spring
Pre-Requisite(s): BL 1020 or BL 1040
BL 3300 - Introduction to Genomics
Introduction to Genomics. Genome organization, mapping and characterization from humans and related organisms. Topics include hierarchical arrangement of genes, genome mapping, molecular markers of physical genome maps, genome sequencing, comparative genomics, analysis of important human genes and their products, and ethical and legal aspects of genomics.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): (BL 1020 or BL 1040) and (BL 2100 or CH 4710)
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: (3-0-0)
Semesters Offered: Spring
Pre-Requisite(s): BL 1020 or BL 1040
BL 3320 - 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 3330 - Environmental Toxicology and Society
Investigates the immune defense system that has evolved to protect vertebrates from invading pathogens and cancer. Covers general principles of innate and acquired immunity, immunodeficiency and autoimmune diseases, as well as transplantation immunology, and the role of apoptosis in lymphocyte maturation.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Major(s): Biochem & Molecular Biology-Bio Sc, Biomedical Engineering, Bioinformatics, Biological Sciences, Clinical Laboratory Science; May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): BL 1020 or BL 1040 or BL 2020
BL 3500 - 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
Pre-Requisite(s): (BL 1020 or BL 1040 or BL 2010) and BL 2100 and (CH 2400 or CH 2420)
BL 3501 - Biochemistry II
Dynamic aspects of living systems. Broad exposure to cellular metabolic pathways, intermediary metabolism and its regulation and bioenergetics.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Pre-Requisite(s): BL 4010
BL 3850 - Environmental Toxicology and Society
Investigates the social consequences of environmental poisons on human health and communities, with a focus on global effects and the unequal burden of toxic exposure. Toxicology lectures cover testing methods, bioactivation, carcinogenic and teratogenic effects, and target organs. Discussion covers case studies of community poisoning, toxin regulation, and political debate.
Credits: 3.0
Lec-Rec-Lab: (1-2-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2000-2001 academic year
Restrictions: May not be enrolled in one of the following Class(es): Biological Sciences, Clinical Laboratory Science; May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): UN 2002
BL 3970 - Current Health Issues
Discusses current topics relevant to human health, including coronary disease, hypertension, hyperlipidemia, smoking cessation, alcohol abuse, obesity, osteoporosis, breast cancer, epididymitis, prostate cancer, anorexia and bulimia, sexually transmitted diseases, and postpartum thyroid dysfunction.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): UN 2002
BL 3990 - Biological Sciences Teaching Experience
Development of teaching skills through assisting in the instruction of a section of biological sciences laboratory. Students gain experience in leadership, group work, organization skills, laboratory preparation, and laboratory instruction.
Credits: variable to 4.0; Repeatable to a Max of 4
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of instructor required
BL 4000 - Special Problems in Biology
A literature and laboratory research problem that culminates in a written report on the work performed.
Credits: variable to 9.0; Repeatable to a Max of 9
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of instructor required
BL 4001 - Honors Research in Biology
A laboratory-based research problem that culminates in a written report and a seminar presentation on the work performed. Open only to biological sciences and clinical laboratory sciences majors accepted into the Honors in Biological Sciences program.
Credits: variable to 9.0; Repeatable to a Max of 9
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of instructor required; Must be enrolled in one of the following Major(s): Bioinformatics, Biological Sciences, Clinical Laboratory Science
BL 4010 - Biochemistry I
Structure, biochemical properties, and function of important biomolecules such as proteins and nucleic acids. Introduces enzyme biochemistry (structure, function, catalysis, kinetics, and inhibition).
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Pre-Requisite(s): (BL 1020 or BL 1040 or BL 2010) and BL 2100 and (CH 2400 or CH 2420)
BL 4020 - Biochemistry II
Dynamic aspects of living systems. Broad exposure to cellular metabolic pathways, intermediary metabolism and its regulation and bioenergetics.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Pre-Requisite(s): BL 4010
BL 4030 - Molecular Biology
Molecular biology of gene structure, expression and regulation. Also topics covering various molecular techniques and applications of these techniques and biotechnology.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): (BL 1020 or BL 1040) and (BL 2100 or CH 4710)

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

BL 4100 - Special Topics in Biological Sciences
A study of recent developments in the biological sciences.
Credits: variable to 10.0. Repeatable to a Max of 10
Semesters Offered: Fall, Spring

BL 4130 - Physiology
 Morphology, distribution, physiology, ultrastructure, taxonomy, and economic significance of freshwater and marine algae.
Credits: 3.0
Lec-Rec-Lab: (0-2-3)
Semesters Offered: Fall - Offered alternate years beginning with the 2001-2002 academic year
Pre-Requisite(s): BL 2160

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

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

BL 4230 - Virology
Comparison of bacterial, animal, and plant viruses, including a detailed study of viral structure and host-virus interaction in the viral replication process. Discusses important current areas of viral research, virulence suppression, and oncogene theory.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall - Offered alternate years beginning with the 2003-2004 academic year
Pre-Requisite(s): BL 2100(C)

BL 4320 - Histology
Basic tissue structures and organs of the vertebrate organisms with emphasis on the human.
Credits: 4.0
Lec-Rec-Lab: (0-3-3)
Semesters Offered: Spring
Pre-Requisite(s): BL 2100 and BL 2020

BL 4330 - Embryology Laboratory
Laboratory study of developmental events in the star fish, frog, chicken, and pig using living and preserved materials. Topics include fertilization, cleavage, gastrulation, metamorphosis, and regeneration.
Credits: 1.0
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Fall - Offered alternate years beginning with the 2006-2007 academic year
Pre-Requisite(s): BL 2100 and BL 2020

BL 4360 - Cell and Developmental Biology
The study of progressive and irreversible change in organisms from a cellular and molecular perspective. Topics include eukaryotic cell structure and function, cellular communication and regulation of gene function, as well as hormonal and environmental influences on gene expression, differentiation and morphogenesis. Examples are drawn from the development of fungi, plants, invertebrates and vertebrates.
Credits: 4.0
Lec-Rec-Lab: (4-0-0)
Semesters Offered: Spring
Pre-Requisite(s): (BL 2100 or CH 4710) and BL 2200

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

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

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

BL 4450 - Limnology
Introductory study of interrelated physical, chemical, and biological processes of freshwater lakes. Field work on local lakes emphasized.
Credits: 4.0
Lec-Rec-Lab: (0-3-3)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): CH 1120

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

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

BL 4500 - Critical Discussions in Bioinformatics
Critical discussions of current topics in bioinformatics. Oral and written presentations requiring synthesis of information from various sources including primary literature.
Credits: 2.0
Lec-Rec-Lab: (0-2-0)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): BL 3300
BL 4510 - Senior Essay
Reading, interpreting, and integrating information from the primary literature of biological sciences. Emphasizes oral and written presentation skills.
Credits: 2.0
Lec-Rec-Lab: (0-2-0)
Semesters Offered: Fall, Spring
Restrictions: Must be enrolled in one of the following Major(s): Biochem & Molec Biology-Bio Sc, Biological Sciences; May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior

BL 4520 - Bioethics
Moderated, objective discussion regarding the ethical issues arising from biotechnological advances. Issues are dissected using a normative ethics framework. Topics include general research ethics, use of genetically modified organisms, eco-ethics, genetic screening, behavioral genetics, cloning, stem cells, agribiotechnology, and privacy and property rights.
Credits: 2.0
Lec-Rec-Lab: (0-2-0)
Semesters Offered: Freshman, Sophomore
Restrictions: Must be enrolled in one of the following Major(s): Biological Sciences, Lab Sciences
Pre-Requisite(s): BL 2200(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; May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): BL 2020 and BL 2410 and BL 3640

BL 4610 - Clinical Laboratory Science Clinical Practicum I
Practical and didactic training in clinical chemistry, immunopathology, and medical microbiology under the direction of National Accrediting Agency for the Clinical Laboratory Sciences (NAACLS)-approved/accredited hospital internship program personnel.
Credits: 15.0
Lec-Rec-Lab: (15-0-0)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Major(s): Clinical Laboratory Science
Pre-Requisite(s): BL 4610

BL 4611 - Clinical Laboratory Science Clinical Practicum II
Practical and didactic training in hematology, urinalysis, and immunohematology under the direction of National Accrediting Agency for the Clinical Laboratory Sciences (NAACLS)-approved/accredited hospital internship program personnel.
Credits: 15.0
Lec-Rec-Lab: (15-0-0)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Major(s): Clinical Laboratory Science
Pre-Requisite(s): BL 4610

BL 4620 - Histotechnology Practicum I
Practical and didactic training in sample processing, microtome use, staining, instrumentation, grossing, embedding, and microscopy under the direction of National Accrediting Agency for the Clinical Laboratory Sciences (NAACLS)-approved/accredited hospital internship program personnel. Acceptance by a NAACLS-approved/accredited histotechnologist hospital internship program required.
Credits: 14.0
Lec-Rec-Lab: (14-0-0)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Major(s): Clinical Laboratory Science
Pre-Requisite(s): BL 4620

BL 4621 - Histotechnology Practicum II
Practical and didactic training in histochemistry, DNA immunohistochemistry techniques, research methods, management, and safety under the direction of National Accrediting Agency for the Clinical Laboratory Sciences (NAACLS)-approved/accredited hospital internship program personnel.
Credits: 14.0
Lec-Rec-Lab: (14-0-0)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Major(s): Clinical Laboratory Science
Pre-Requisite(s): BL 4620

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

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

BL 4640 - Clinical Immunology & Serology
Integrates basic and clinical immunological principles as well as outlines the diagnosis and evaluation of immune disorders and selected infectious diseases.
Credits: 2.0
Lec-Rec-Lab: (2-0-0)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Major(s): Biological Sciences, Clinical Laboratory Science; Must be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): BL 2410 and BL 3640

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

BL 4720 - Hematology and Hemositology
Theory and laboratory applications. Emphasis will be placed on hematopoiesis, normal and disease states affecting blood cells and coagulation processes. The lab will focus on cell morphology and practical testing applications.
Credits: 3.0
Lec-Rec-Lab: (2-0-3)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Major(s): Biological Sciences, Clinical Laboratory Science; Must be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): BL 4730(C)

BL 4730 - Immunohematology Techniques
Theory and practical applications. Emphasis will be placed on blood antigens and antibodies, compatibility testing techniques, blood component therapy and safety issues.
Credits: 1.0
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Major(s): Biological Sciences, Clinical Laboratory Science; Must be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): BL 4730(C)

BL 4740 - Introduction to Mycology
The taxonomy and biology of major groups of fungi, focusing on their ecology and physiology. Emphasizes organisms of interest in medicine and forest ecology.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Fall - Offered alternate years beginning with the 2004-2005 academic year
Pre-Requisite(s): BL 1020 or BL 1040

BL 4750 - Clinical Laboratory Instrumentation
An overview of the principles, applications, and selection of instruments used in clinical laboratory. Lab work includes operation, maintenance, and trouble shooting to obtain experience working with power supplies, centrifuges, spectrophotometers, pH meters, osmometers, radiation counters, and chemistry analyzers, blood cell counters, and other instruments commonly used in a diagnostic laboratory.
Credits: 2.0
Lec-Rec-Lab: (0-1-3)
Semesters Offered: Spring
BL 4810 - Plant Taxonomy
The classification system and the criteria for classification employed in the plant kingdom with emphasis on identification of vascular plants. A three-week field course during 1st track of summer semester. Class days include Saturdays.
Credits: 3.0
Lec-Rec-Lab: (0-2-3)
Semesters Offered: Summer

BL 4820 - Biochemical Laboratory Techniques I
Laboratory techniques basic to biochemistry and molecular biology including protein and phospholipid determinations, purification of natural and recombinant enzymes, enzyme kinetics, polyacrylamide gel electrophoresis, techniques of cell disruption, membrane isolation and purification using sucrose density gradients, phospholipid and fatty acid compositional analysis.
Credits: 2.0
Lec-Rec-Lab: (0-1-3)
Semesters Offered: Spring
Pre-Requisite(s): BL 4010(C) or CH 4710(C)

BL 4830 - Advanced Biochemical Techniques
Advanced Biochemical Techniques is designed to provide students with a rigorous exposure to the techniques and procedures utilized in the areas of Biochemistry. Emphasis will be placed on an active role of the student in the design of experiments and the collection and interpretation of biochemical data. Students will use microbial systems to construct and characterize experimental strains, monitor and interpret growth data and evaluate microbial regulatory systems via the use of measurements of enzyme specific activity, cell growth and viability and protein and nucleic acid synthesis.
Credits: 2.0
Lec-Rec-Lab: (1-0-3)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): (BL 4010 or CH 4710) and BL 4820

BL 4840 - Molecular Biology Techniques
Laboratory techniques in molecular biology, including methods of recombinant DNA technology for identification, cloning, and characterization of genes.
Credits: 3.0
Lec-Rec-Lab: (1-0-4)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): (BL 2100 or CH 4710) and BL 2200 and BL 4030(C)

BL 4860 - Toxicology
Focuses on principles and testing methods used to describe effects of chemical agents on biological material. Includes carcinogenic, mutagenic, and teratogenic effects and target organs of toxins. Also covers harmful effects of environmental agents such as pesticides and metals on humans, animals, and ecosystems.
Credits: 3.0
Lec-Rec-Lab: (2-1-0)
Semesters Offered: Fall
Pre-Requisite(s): BL 1020 or BL 1040

BL 4979 - Clinical Laboratory Administration and Management
A study of laboratory management and administration. Topics include human resource management, financial management, operations management and career success. Basic laboratory statistics will be covered with the emphasis on quality assurance and total quality management.
Credits: 2.0
Lec-Rec-Lab: (0-2-0)
Semesters Offered: Spring
Pre-Requisite(s): BL 2410

BL 4995 - Research in Biochemistry
A literature and laboratory research problem in biochemistry that culminates in a written report on the work performed.
Credits: variable to 6.0; Repeatable to a Max of 9
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of instructor required; Must be enrolled in one of the following Major(s): Bioinformatics, Biological Sciences, Chemistry, Clinical Laboratory Science, Biochem & Molec Biology-Bio Sc; May not be enrolled in one of the following Class(es): Freshman

Civil & Environmental 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 1501 - Experiences in Environmental Engineering
Provides a series of activities that explore the field of environmental engineering. Through completion of the course, students will gain fundamental experiences with the skills, knowledge, and attitudes needed to solve the complex environmental problems needing solutions from today's environmental engineers.
Credits: 1.0
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Fall

CE 2201 - Structural Engineering I
The application of statics and mechanics of materials to the analysis of trusses, determinate and indeterminate beams, and small frames. An introduction to the application of dynamics to civil engineering problems.
Credits: 4.0
Lec-Rec-Lab: (3-0-2)
Semesters Offered: Fall, Spring
Pre-Requisite(s): ENG 2120 or MEEM 2150

CE 3101 - Civil Engineering Materials
Covers properties and behavior of typical civil engineering materials, including wood, metals, aggregates, asphalt cement concrete, Portland cement concrete, and composites. Laboratory exercises demonstrate selected engineering mechanics principles, including elastic, inelastic, and time-dependent material behavior. Additional topics include testing techniques, materials standards, report writing, and presentation of experimental data.
Credits: 3.0
Lec-Rec-Lab: (0-2-3)
Semesters Offered: Fall, Spring
Pre-Requisite(s): ENG 2120 or MEEM 2150

CE 3201 - Structural Engineering II
Introduction to the design of basic civil engineering structural components in steel and reinforced concrete. The Load and Resistance Factor Design method is applied to steel tension, compression, and flexural members and to basic connections. The Ultimate Strength Design method is applied to concrete flexural members.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring
Pre-Requisite(s): CE 2201

CE 3331 - Professional Practice
Technical, legal, and ethical considerations in civil engineering practice are illustrated through examination of contract specifications and technical specification writing.
Credits: 2.0
Lec-Rec-Lab: (2-0-0)
Semesters Offered: Fall, Spring, Summer
Restrictions: May not be enrolled in one of the following Class(es): Freshman

CE 3332 - Fundamentals of Construction Engineering
Introduction to concepts required by professionals involved in the construction industry. Includes contracts, bidding, estimating, scheduling, cash flow, safety, labor issues, equipment ownership, and productivity.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
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 geometry 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
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
CE 3501 - Environmental Engineering Fundamentals
Basic principles and calculations for environmental engineering. Covers application of mass balance, energy balance, and physical/chemical/biological principles to water and wastewater treatment, surface water quality, air quality, solid waste management, and groundwater quality.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): MA 2160 and (CH 1100 or CH 1110)

CE 3502 - Environmental Monitoring and Measurement Analysis
Introduction to environmental data acquisition and interpretation, fundamentals of environmental monitoring, instrumentation, measurement techniques, and statistical analyses. Measurements are conducted in a variety of engineered and natural environments. Probability and statistical analyses are applied to the collected data.
Credits: 3.0
Lec-Rec-Lab: (0-2-3)
Semesters Offered: Spring
Pre-Requisite(s): MA 2160 and (CH 1100 or CH 1110)

CE 3503 - Environmental Engineering
Application of fundamental chemical, biological, and physical principles of environmental engineering to design and operation of systems used for water and wastewater treatment, solid waste management, air pollution control, and analysis of quality of surface water, air, and groundwater.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring, Summer
Pre-Requisite(s): MA 2160 and (CH 1100 or CH 1110)

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

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

CE 3810 - Soil Mechanics for Engineers
Develops the terminology and descriptions common to the field. Studies soil compressibility, fluid flow, response to mechanical compaction, and strength as well as methods of determining geostatic stresses and stress changes due to boundary loadings. An experimental laboratory experience reinforces the lecture material.
Credits: 4.0
Lec-Rec-Lab: (3-0-3)
Semesters Offered: Fall, Spring, Summer
Pre-Requisite(s): GE 2000 and (ENG 2120 or ENG 2150) and (ENG 3200 or ENG 3507)

CE 4201 - Matrix Structural Analysis
Analysis of trusses and frames by the direct stiffness method. Use of a typical commercial computer code is stressed as a tool for complex structures. Introduces three-dimensional structures.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Fall
Pre-Requisite(s): CE 3201

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

CE 4221 - Structural Steel Design
Design of steel frame structures by the Load and Resistance Factor Design method. Covers flexural members including unbraced beams, and plate girders as well as columns under combined bending and axial loads, including basic moment magnification techniques. Studies design of selected simple and rigid beam to column connections and introduces composite members.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): CE 3201

CE 4231 - Timber and Masonry Design
Introduction to timber design and wood as a structural engineering material. Includes beams, columns, and nailed and bolted connections. Introduction to masonry materials and design. Includes flexural design, plasters, and shear wall design.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): CE 3201

CE 4333 - Estimating, Planning and Control of Construction Projects
Examination of the different types of estimates and the function of each type. Explores drawing interpretation and quantity take-off techniques leading to the development of an estimate. Shows relationship between contract specification, drawings, project control. The estimate will be illustrated.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Fall
Pre-Requisite(s): CE 3331 and CE 3332

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

CE 4338 - Computer Based Project Management
Integrate information from scheduling and estimating computer programs to use as tools to monitor, control, and manage projects. The course will develop a student's ability to use computer tools to interconnect the traditionally isolated project cost and schedule information.
Credits: 3.0
Lec-Rec-Lab: (3-0-3)
Semesters Offered: Fall
Pre-Requisite(s): CE 3332

CE 4401 - Pavement Design
Analysis, behavior, performance, and structural design of highway pavements. Introduces pavement types and performance concepts, highway traffic and subgrade characterization, materials employed in highway construction, and highway drainage. Presents common methods used for designing pavement structures as well as mechanistic-empirical approaches.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): CE 3401

CE 4402 - Traffic Engineering
Introduction to traffic engineering, traffic characteristics, data collection techniques, capacity analysis, traffic control devices, intersection control, traffic signal systems, parking, and street operations.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Summer
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore

CE 4501 - Environmental Engineering Chemical Processes
Application of chemistry, conservation principles, and mathematics to the analysis of chemical processes occurring in natural and engineered environments. Topics include acid-base phenomena, the carbonate system, precipitation/dissolution, redox chemistry, diffusion, mass transfer, and applications to engineering design. Laboratory experiences illustrate principles and modern measurement.
Credits: 4.0
Lec-Rec-Lab: (0-3-3)
Semesters Offered: Fall
Pre-Requisite(s): CE 3333

CE 4502 - Air Quality Engineering and Science
Overview of air quality regulation in the U.S. and world, including basic concepts of atmospheric chemistry and transport; fugitive, point, and area emissions; principles and tradeoffs of operation and design of air pollution control systems; and application of air quality models.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): CE 3501 or CE 3503

CE 4503 - Environmental Engineering Chemical Processes
(CE 3501 or CE 3503) and CE 3502 and CH 3500(C)

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

Undergraduate Course Descriptions, 2007-08, Page 14 of 86
CE 4505 - Surface Water Quality Engineering
Develops the scientific basis for water quality management in lakes and rivers. Considers the origin, behavior, and fate of nutrients and toxic substances. Introduces engineered approaches for lake management, including mass balance modeling. Presents techniques for water quality restoration and the legal framework supporting pollution control.
Credits: 3.0
Lec-Rec-Lab: (0-2-3)
Semesters Offered: Fall
Pre-Requisite(s): CE 3501 or CE 3503

CE 4506 - Application of Environmental Regulations and Pollution Prevention to Engineering Practice
Study of the federal and state regulations and policy that govern management of solid and hazardous waste and how these regulations are incorporated into engineering practice. Other topics include sustainability and eco-business innovation, brownfield redevelopment, risk assessment, and engineering ethics.
Credits: 3.0
Lec-Rec-Lab: (2-0-1)
Semesters Offered: Spring
Pre-Requisite(s): CE 3501 or CE 3503

CE 4507 - Water Distribution and Wastewater Collection Design
Application of basic principles in civil and environmental engineering to the analysis and design of water distribution systems, wastewater collection systems, air distribution and collection systems, and their appurtenances.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Pre-Requisite(s): CE 3620 or CE 3600 and (CE 3501 or CE 3503)

CE 4508 - Water and Wastewater Treatment
Principles of physical, chemical and biological processes engaged 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: Spring
Pre-Requisite(s): ENG 3507 or ENG 3200 and (CE 3501 or CE 3503)

CE 4509 - Environmental Process & Simulation
Provides a rigorous hands-on introduction to process control, laboratory and pilot-plant experimentation focused on physical, chemical and biological treatment systems used in environmental engineering.
Credits: 2.0
Lec-Rec-Lab: (0-0-5)
Semesters Offered: Spring
Pre-Requisite(s): CE 4508 and (CE 3501 or CE 3503) and (CE 3620 or CE 3600) and CE 4501

CE 4510 - Baccalaureate Thesis
Independent baccalaureate research project performed under the supervision of one or more faculty.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring
Restrictions: Permission of instructor required; May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior

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

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

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

CE 4630 - Hydraulic Structures
Analysis and design of water regulating structures. Includes dams, spillways, gates, dikes, levees, stilling basins, culverts, and various minor structures.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Pre-Requisite(s): CE 3502 or CE 3600

CE 4820 - Foundation Engineering
Applies the fundamentals learned in CE 3810 to problems in geotechnical engineering. Learn the procedures used to design footings, piled foundations, retaining walls, marine structures, and slopes. Computational laboratory reinforces lectures; students have direct access to the instructor as the design is being developed.
Credits: 3.0
Lec-Rec-Lab: (2-0-2)
Semesters Offered: Fall
Pre-Requisite(s): CE 3201 and CE 3810

CE 4830 - Geosynthetics Engineering
Geosynthetic materials are grouped by mechanical characteristics and engineering use. They are widely used in highway, landfill, and embankment design. Develop designs for filters, soil separators, reinforced earth, and impermeable membranes. Also learn when using a geotextile is appropriate.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: On Demand
Pre-Requisite(s): CE 3101

CE 4840 - Aggregate Engineering & Utilization
Introduction into various aspects of aggregate exploration, production, and utilization. Topics covered include geophysical techniques for aggregate exploration, environmental issues in aggregate production including surface and underground mining concepts, crushing and sizing and aggregate utilization in Civil Engineering applications.
Credits: 3.0
Lec-Rec-Lab: (0-2-3)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior

CE 4900 - Engineering Design Project I
An engineering design project related to civil and environmental engineering. Not available to students who have taken CE 4905. Students must complete both CE 4900 and CE 4910 to get credit for either one. (Senior project ready as defined by major substitutes for prerequisites)
Credits: 3.0
Lec-Rec-Lab: (0-2-3)
Semesters Offered: Fall, Spring, 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 CE 4900 or CE 4910. (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 CE 4900. Not available to students who have taken CE 4905. Students must complete both CE 4900 and CE 4910 to get credit for either one. (Senior project ready as defined by major substitutes for prerequisites)
Credits: 3.0
Lec-Rec-Lab: (0-2-3)
Semesters Offered: Spring
Pre-Requisite(s): CE 4900

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

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

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

**CH 0011 - Development of Chemistry Skills**
Individual appointment or team learning group with an undergraduate student coach to provide chemistry and learning skills development for students enrolled in General or University Chemistry lectures. Credits do not count toward graduation.

**Credits:** 0.0
**May be repeated**
**Semesters Offered:** Fall, Spring, Summer

**CH 1000 - Preparatory Chemistry**
Fundamental principles, laws, and theories of chemistry for students who have not taken high school chemistry, but who have one unit of high school algebra or equivalent.

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

**CH 1100 - General Chemistry**
Introduces the foundations of chemistry, including electronic structure of atoms and molecules, intermolecular forces, states of matter, chemical reactions, organic chemistry, chemical equilibria, kinetics, and acid-base chemistry. Includes laboratory component that emphasizes lecture concepts. Not recommended for students in programs requiring one year of first-year chemistry.

**Credits:** 4.0
**Lec-Rec-Lab:** (3-0-3)
**Semesters Offered:** Fall, Spring, Summer
**Co-Requisite(s):** CH 1110

**CH 1110 - University Chemistry I**
Introduces experimental and theoretical foundations of chemistry, including electronic structure of atoms and molecules, intermolecular forces, states of matter, chemical reactions, gas laws, thermochemistry, and chemical kinetics. Not recommended for students in programs requiring only one semester of first-year chemistry.

**Credits:** 4.0
**Lec-Rec-Lab:** (3-1-0)
**Semesters Offered:** Fall, Spring, Summer
**Co-Requisite(s):** CH 1110

**CH 1111 - University Chemistry Lab I**
Laboratory to accompany CH1110.

**Credits:** 1.0
**Lec-Rec-Lab:** (0-0-3)
**Semesters Offered:** Fall, Spring, Summer
**Co-Requisite(s):** CH 1110

**CH 1120 - University Chemistry II**
A continuation of CH 1110. Introduces more complex concepts in chemistry, including kinetics, chemical equilibria, acid-base equilibria, thermodynamics, electrochemistry, and chemical analysis. Additional topics may include chemistry of the metals and non-metals, biochemical systems, and nuclear chemistry. Includes laboratory component that emphasizes lecture concepts.

**Credits:** 4.0
**Lec-Rec-Lab:** (3-0-3)
**Semesters Offered:** Fall, Spring, Summer
**Co-Requisite(s):** CH 1110

**CH 1121 - University Chemistry II**
Continuation of CH1120. 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:** Fall, Summer
**Co-Requisite(s):** CH 2410 (C) or CH 2400 (C) and CH 1120

**CH 2212 - Quantitative Analysis**
Measurements and calculations relevant to volumetric and gravimetric analysis as well as electrochemistry and separations. Error analysis and statistical treatment of data. In the laboratory, introduces classical and contemporary techniques that require high quality measurements.

**Credits:** 5.0
**Lec-Rec-Lab:** (3-0-6)
**Semesters Offered:** Spring
**Pre-Requisite(s):** CH 1120

**CH 2400 - Principles of Organic Chemistry**
Discusses properties and reactions of various functional groups using reaction mechanisms as a unifying theme. Emphasizes practical applications using industrial, environmental, current events, and biological/medicinal examples. Not open to students whose programs require CH2410.

**Credits:** 4.0
**Lec-Rec-Lab:** (4-0-0)
**Semesters Offered:** Fall
**Restrictions:** May not be enrolled in one of the following Major(s): Biological Sciences, Chemistry

**Pre-Requisite(s):** CH 1120

**CH 2410 - Organic Chemistry I**
A study of the chemistry of carbon compounds. Review of hybrid orbitals, covalent bonding, and resonance. Introduction to nomenclature, stereochemistry, infrared and nuclear magnetic resonance spectroscopy, functional group chemistry based on reaction mechanisms, and multi-step synthesis.

**Credits:** 3.0
**Lec-Rec-Lab:** (3-0-0)
**Semesters Offered:** Fall, Summer
**Pre-Requisite(s):** CH 1120

**CH 2411 - Organic Chemistry Lab I**
Laboratory to accompany CH2410 and CH2400.

**Credits:** 1.0
**Lec-Rec-Lab:** (0-0-3)
**Semesters Offered:** Fall, Spring, Summer
**Co-Requisite(s):** CH 2410 or CH 2400

**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
**Co-Requisite(s):** CH 2410 or CH 2400

**CH 2421 - Organic Chemistry Lab II**
Laboratory to accompany CH2420.

**Credits:** 2.0
**Lec-Rec-Lab:** (0-0-4)
**Semesters Offered:** Spring, Summer
**Co-Requisite(s):** CH 2411 and CH 2420 (C)

**CH 3020 - Laboratory Teaching Internship**
Requires teaching a section of undergraduate laboratory under professional supervision. Emphasizes communicating good laboratory practice and technique to beginning students as well as maintaining a safe working environment. Includes safety training and teaching orientation. Required for certification in the ACS chemistry/education option.

**Credits:** 2.0
**Lec-Rec-Lab:** (0-0-4)
**Semesters Offered:** Fall, Spring
**Restrictions:** Permission of instructor required; May not be enrolled in one of the following Class(es): Freshman, Sophomore

**CH 3500 - Physical Chemistry for Environmental and Life Sciences**
Equilibrium thermodynamics, chemical kinetics, transport properties, gas laws, and phase equilibria with an emphasis on solution behavior and applications to molecules important in the environmental and life sciences.

**Credits:** 2.0
**Lec-Rec-Lab:** (2-0-0)
**Semesters Offered:** Fall
**Restrictions:** May not be enrolled in one of the following Major(s): Chemical Engineering, Chemistry

**Pre-Requisite(s):** (CH 1120 or CH 1140) and MA 2160

**CH 3501 - Physical Chemistry for Environmental and Life Sciences**
Equilibrium thermodynamics, chemical kinetics, transport properties, gas laws, and phase equilibria with an emphasis on solution behavior and applications to molecules important in the environmental and life sciences. Course offered first half of spring semester.

**Credits:** 2.0
**Lec-Rec-Lab:** (4-0-0)
**Semesters Offered:** Spring
**Restrictions:** May not be enrolled in one of the following Major(s): Chemistry, Chemical Engineering

**Pre-Requisite(s):** (CH 1120 or CH 1140) 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 equilibrium, the laws of thermodynamics, solid-liquid-vapor equilibria, the chemical potential, chemical equilibrium, electrochemistry, the phase rule, phase diagrams, and chemical kinetics.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring
Pre-Requisite(s): CH 1120 and PH 2200(C) and MA 2160

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

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

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

CH 3540 - Biophysical Chemistry
Examines fundamental physical principles underlying complex biological systems in order to understand the interactions and behaviors found in biological, biochemical, and physical systems. Topics include macromolecules in aqueous environments, spectroscopy and structure determination, kinetics, membranes, and transport phenomena.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Pre-Requisite(s): CH 1120 and PH 2200 and MA 2160 and (BL 1020 or BL 1040)

CH 3541 - Biophysical Chemistry Laboratory
Examines the physical methods employed in the study of biological systems, including structure determination, spectroscopy, microscopy, imaging, and modeling. The core objective is application of the fundamentals developed in the Biophysical Chemistry course to systems of biological relevance.
Credits: 2.0
Lec-Rec-Lab: (0-0-4)
Semesters Offered: Spring
Co-Requisite(s): CH 3540

CH 4110 - Pharmaceutical Chemistry I: Drug Action
Focuses on structural and mechanistic approaches to pharmaceuticals and drug action. General principles of absorption, distribution, action, metabolism and toxicity of drugs will be presented followed by action of drug classes such as antibiotics, cardiovascular, and anti-inflammatory drugs.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): CH 4710 or BL 4010

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

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

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

CH 4212 - Instrumental Analysis
Chemical instrumentation applied to organic and inorganic analysis with emphasis on chromatography and spectroscopy.
Credits: 5.0
Lec-Rec-Lab: (3-0-6)
Semesters Offered: Fall
Pre-Requisite(s): CH 2212 and CH 3510(C) and CH 3511(C)

CH 4222 - Introduction to Quantitative and Instrumental Analysis
Measurements and calculations relevant to volumetric and gravimetric techniques. Error analysis and statistical treatment of data. Basic chemical instrumentation applied to organic and inorganic analysis with emphasis on chromatography and spectroscopy.
Credits: 5.0
Lec-Rec-Lab: (3-0-6)
Semesters Offered: Fall
Restrictions: Permission of instructor required; 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 1120 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 1120

CH 4231 - Introduction to Spectroscopy
Laboratory-intensive course offered by arrangement. Students will learn how to recognize compounds suitable for spectrosopic analysis. Sample preparation and quantitative analysis will be emphasized. An introduction to spectroscopic 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 1120

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 1120

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 1120

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

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

CH 4292 - Independent Study in Analytical Chemistry
An undergraduate research experience in analytical chemistry. Students select a literature and/or laboratory problem and write a summary report.
Credits: variable to 3.0; Repeatable to a Max of 9
Semesters Offered: On Demand
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Title</th>
<th>Description</th>
<th>Credits</th>
<th>Lec-Rec-Lab</th>
<th>Semesters Offered</th>
<th>Pre-Requisite(s)</th>
<th>Restrictions</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH 4310</td>
<td>Inorganic Chemistry I</td>
<td>Study of the bonding, physical and chemical properties, structure and reactions of the chemical elements and their compounds. Examples will include both transition metals and main group elements.</td>
<td>3.0</td>
<td>(3-0-0)</td>
<td>On Demand</td>
<td>CH 3520</td>
<td></td>
</tr>
<tr>
<td>CH 4311</td>
<td>Inorganic Chemistry Laboratory</td>
<td>Laboratory preparations (selected inorganic and organometallic compounds) that illustrate appropriate experimental techniques for syntheses, manipulations, and methods of analyses.</td>
<td>2.0</td>
<td>(0-0-4)</td>
<td>Fall</td>
<td>CH 4310(C)</td>
<td></td>
</tr>
<tr>
<td>CH 4320</td>
<td>Inorganic Chemistry II</td>
<td>Continuation of CH4310. A survey course that continues the study of the general principles of inorganic chemistry and the chemistry of the elements and their compounds.</td>
<td>3.0</td>
<td>(3-0-0)</td>
<td>Spring</td>
<td>CH 4310</td>
<td></td>
</tr>
<tr>
<td>CH 4390</td>
<td>Current Topics in Inorganic Chemistry</td>
<td>Discussion of recent topics in inorganic chemistry.</td>
<td>3.0</td>
<td>(3-0-0)</td>
<td>Fall</td>
<td>CH 4390</td>
<td></td>
</tr>
<tr>
<td>CH 4412</td>
<td>Spectroscopy of Organic Chemistry</td>
<td>Emphasizes use of spectral data interpretation to determine structures of organic compounds. Discusses proton and carbon nuclear magnetic resonance (including two-dimensional techniques, COSY, HETCOR, etc.), mass spectrometry, infrared spectrophotometry. Includes use of modern software, including NMR spectrum modeling, data handling and presentation, and spectral database packages.</td>
<td>3.0</td>
<td>(2-0-3)</td>
<td>Spring</td>
<td>CH 4240</td>
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</tr>
<tr>
<td>CH 4430</td>
<td>Intermediate Organic Chemistry</td>
<td>Develop the chemical intuition necessary for advanced work in organic chemistry. Emphasizes reaction mechanisms and why reactions occur. Topics include heteroaromatic 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.</td>
<td>3.0</td>
<td>(3-0-0)</td>
<td>Fall</td>
<td>CH 4240</td>
<td></td>
</tr>
<tr>
<td>CH 4490</td>
<td>Current Topics in Organic Chemistry</td>
<td>Discussion of recent topics in organic chemistry.</td>
<td>3.0</td>
<td>(3-0-0)</td>
<td>Fall</td>
<td>CH 4240</td>
<td></td>
</tr>
<tr>
<td>CH 4510</td>
<td>Intermediate Physical Chemistry</td>
<td>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.</td>
<td>3.0</td>
<td>(3-0-0)</td>
<td>Fall</td>
<td>CH 3520</td>
<td></td>
</tr>
<tr>
<td>CH 4515</td>
<td>Atmospheric Chemistry</td>
<td>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.</td>
<td>3.0</td>
<td>(3-0-0)</td>
<td>Spring</td>
<td>CH 3510 and CH 3520(C); or (CE 4501 and CE 4504)</td>
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</tr>
<tr>
<td>CH 4560</td>
<td>Computational Chemistry</td>
<td>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.</td>
<td>3.0</td>
<td>(3-0-0)</td>
<td>Fall</td>
<td>CH 3520</td>
<td></td>
</tr>
<tr>
<td>CH 4590</td>
<td>Current Topics in Physical Chemistry</td>
<td>Discussion of recent topics in physical chemistry.</td>
<td>3.0</td>
<td>(3-0-0)</td>
<td>Fall</td>
<td>CH 4590</td>
<td></td>
</tr>
<tr>
<td>CH 4610</td>
<td>Introduction to Polymer Science</td>
<td>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.</td>
<td>3.0</td>
<td>(3-0-0)</td>
<td>Fall</td>
<td>CH 4610(C) or CM 4610(C)</td>
<td></td>
</tr>
<tr>
<td>CH 4620</td>
<td>Polymer Chemistry</td>
<td>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.</td>
<td>3.0</td>
<td>(3-0-0)</td>
<td>Fall</td>
<td>CH 4240 or CH 4200</td>
<td></td>
</tr>
<tr>
<td>CH 4631</td>
<td>Polymer Science Laboratory</td>
<td>Students undertake experiments covering aspects of polymer characterization, processing, and recycling. Also included are experiments in applications such as coatings, adhesives, and composites.</td>
<td>2.0</td>
<td>(0-1-3)</td>
<td>Fall</td>
<td>CH 4631</td>
<td></td>
</tr>
<tr>
<td>CH 4690</td>
<td>Current Topics in Polymer Chemistry</td>
<td>Discussion of current topics in polymer chemistry.</td>
<td>3.0</td>
<td>(3-0-0)</td>
<td>Fall</td>
<td>CH 4690</td>
<td></td>
</tr>
<tr>
<td>CH 4710</td>
<td>Biomolecular Chemistry I</td>
<td>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.</td>
<td>3.0</td>
<td>(3-0-0)</td>
<td>Fall</td>
<td>CH 4710</td>
<td></td>
</tr>
<tr>
<td>CH 4720</td>
<td>Biomolecular Chemistry II</td>
<td>Focuses on structural and chemical logic of bioprocesses with emphasis on bioorganic mechanisms and the interconnections between biology and chemistry. Bioorganic mechanisms and biophysical concepts in biochemistry are emphasized. Topics include metabolic pathways, membrane biophysics, ion-channels, cell communication, transcriptional control and molecular biology.</td>
<td>3.0</td>
<td>(3-0-0)</td>
<td>Spring</td>
<td>CH 4720</td>
<td></td>
</tr>
<tr>
<td>CH 4790</td>
<td>Current Topics in Biochemistry</td>
<td>Discussion of recent topics in biochemistry.</td>
<td>3.0</td>
<td>(3-0-0)</td>
<td>Fall</td>
<td>CH 4790</td>
<td></td>
</tr>
<tr>
<td>CH 4800</td>
<td>Current Topics in Undergraduate Chemistry</td>
<td>Covers chemistry topics not included in regular courses. Topics may include designing organic syntheses, heterogeneous catalysis, homogeneous catalysis, solid-state chemistry, and heterocyclic chemistry.</td>
<td>3.0</td>
<td>(3-0-0)</td>
<td>Fall</td>
<td>CH 4800</td>
<td></td>
</tr>
</tbody>
</table>
CH 4810 - Design and Operation of a High School Chemistry Lab
Hands-on experience in the operation of a high school chemistry laboratory. Includes the design and preparation of experiments and demonstrations, setting up and maintaining a chemical storeroom, chemical waste disposal, and safety issues. Required for certification in the ACS chemistry/education concentration.
Credits: 2.0
Lec-Rec-Lab: (0-0-6)
Semesters Offered: Spring
Pre-Requisite(s): (CH 2420 and CH 2421) or (CH 2400 and CH 2421) and CH 3020

CH 4900 - Senior Seminar in Chemistry I
Discussion of various topics relevant for professional development.
Credits: 1.0
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Level(s): Graduate; Must be enrolled in one of the following Class(es): Senior

CH 4910 - Senior Seminar in Chemistry II
Discussion of various topics relevant for professional development. Includes preparation of abstracts and reports. Presentation of results of undergraduate research project or assigned library topic in written and oral form.
Credits: 1.0
Lec-Rec-Lab: (0-1-0)
Semesters Offered: 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

CH 4990 - Undergraduate Research in Chemistry
An undergraduate research experience in which students select a literature and laboratory research problem and write a report on the work performed. The student typically signs up for 1 to 3 credits per semester; most problems require more than one semester to complete. Requires GPA of 2.50 or better.
Credits: variable to 6.0; Repeatable to a Max of 12
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of department required

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

Chemical Engineering

CM 2110 - Fund of Chem Enng 1
Application of chemical engineering fundamentals to the design and analysis of chemical processes. Mass balances, energy balances, and fundamentals concepts are applied. Introduces use of Process Flowsheet Simulation Software.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Summer
Pre-Requisite(s): CH 1110 or CH 1100

CM 2120 - Fund of Chem Enng 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: CM 2110

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

CM 3110 - Transport/Unit Operations 1
Develop an understanding of the processes of momentum transfer (fluid mechanics) and heat transfer. Presents the basic equations of microscopic momentum and heat transfer, along with macroscopic transport equations that can be used in engineering analysis.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring
Pre-Requisite(s): CM 2120 and PH 2100 and (MA 3520 or MA 3521 or MA 3530 or MA 3560)

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

CM 3215 - Fundamentals of Chemical Engineering Laboratory
This course will be an introduction to basic laboratory methods and instrumentation used in the measurement of fluid flow, heat transfer, and mass transfer. Topics to be covered include methods of statistical data analysis, experimental design, principles of measurement and instrumentation, and presentation of data.
Credits: 2.0
Lec-Rec-Lab: (1-0-3)
Semesters Offered: Fall, Spring
Pre-Requisite(s): CM 2120 and CM 3110(C) 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: (2-0-2)
Semesters Offered: Spring
Pre-Requisite(s): (MA 3520 or MA 3521 or MA 3530 or MA 3560) and PH 2200

CM 3410 - Tech Comm for Chem Engg
Study of the purposes, genres, and applications of technical communication in chemical engineering professions, including written, oral, visual, and graphic communication. Assignments may include memos, progress reports, procedures, memo and formal reports, research citations, and job-seeking requirements. Emphasizes organization, support, coherence, usefulness, ethics, and professionalism.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring, Summer
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): UN 2001 and UN 2002

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

CM 3510 - Chemical Reaction Engineering
A study of chemical reaction engineering including design and analysis of chemical reactors, the fundamentals of chemical kinetics, and analysis of reaction rate data.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Pre-Requisite(s): CM 3110 and CM 3230(C) and (MA 3520 or MA 3521 or MA 3530 or MA 3560)
CM 3820 - Sampling and Data Analysis
Solids sampling theory, practice, and instrumentation for process streams. Statistics/probability as they apply to representative samples from bulklots. Minimization of errors, proper design of sample collection apparatus, statistical design and analysis, and measurements of temperature, flow rate will be covered.
Credits: 3.0
Lec-Rec-Lab: (2-0-1)
Semesters Offered: Spring - Offered alternate years beginning with the 2006-2007 academic year

CM 3974 - Fuel Cell Fundamentals
This course provides an introduction to fuel cells and fuel cell systems. Topics include an overview of fuel-cell construction, fuel-cell chemistry, fuel-cell losses and efficiency, and integrating fuel cells into vehicles.
Credits: 1.0
Lec-Rec-Lab: (1-0-0)
Semesters Offered: Fall - Offered alternate years beginning with the 2007-2008 academic year
Pre-Requisite(s): CH 1100 or CH 1110

CM 4000 - Chemical Engineering Research
Student undertakes a problem in some phase of chemical engineering, reviews the literature, obtains experimental data, and submits a report.
Credits: variable to 3.0; Repeatable to a Max of 9
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of instructor required

CM 4110 - Unit Operations Laboratory
Provides a rigorous introduction to experiments focused in the unit operations of fluid mechanics, heat transfer, mass transfer, and chemical reaction engineering.
Credits: 3.0
Lec-Rec-Lab: (0-1-6)
Semesters Offered: Fall
Pre-Requisite(s): CM 3120 and CM 3230 and CM 3410 and CM 3510 and CM 4310(C)

CM 4120 - Chemical Plant Operations Lab
A capstone laboratory course focused on chemical manufacturing processes from the perspective of manufacturing excellence. Lecture material includes equality management, the application of statistical process control, and current trends in quality manufacturing. Experimental reinforcement of these concepts occurs in the department’s pilot plants.
Credits: 3.0
Lec-Rec-Lab: (0-1-6)
Semesters Offered: Spring
Pre-Requisite(s): CM 4110

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

CM 4310 - Chemical Process Safety/Env
A study of the technical fundamentals of chemical process safety and designing for the environment. Includes toxicology, industrial hygiene, source models, fires and explosions, relief systems, hazard identification, risk assessment, environmental fate and transport, hazardous waste generation, pollution prevention, and regulatory requirements.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
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: Spring - Offered alternate years beginning with the 2005-2006 academic year

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

CM 4610 - Introduction to Polymer Science
Introductory study of the properties of polymers. Includes structure and characterization of polymers in the solid state, in solution, and as melts. Topics include viscoelasticity, rubber elasticity, rheology and polymer processing. Applications discussed include coatings, adhesives, and composites.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Pre-Requisite(s): CH 1120

CM 4620 - Polymer Chemistry
Study of polymer chemistry dealing with the mechanisms of polymerization and copolymerization. Study of the chemistry of polymers, including polymer modification and degradation. Topics include methods of measuring and predicting the path of degradation and stabilization.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring
Pre-Requisite(s): CH 2420 or CH 2400

CM 4631 - Polymer Science Laboratory
Students undertake experiments covering aspects of polymer characterization, processing, and recycling. Also included are experiments in applications such as coatings, adhesives, and composites.
Credits: 2.0
Lec-Rec-Lab: (0-1-3)
Semesters Offered: Fall
Pre-Requisite(s): CM 4610(C)

CM 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, bioprocesses for product recovery, industrial application, genetic engineering concepts, and applications.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall - Offered alternate years beginning with the 2005-2006 academic year
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): CM 3110(C)

CM 4740 - Hydrometallurgy/Pyrometallurgy
Extracting metal from ores by aqueous chemical techniques. The unit processes and unit operations in the dissolution, solubility, aqueous chemistry, concentrating and purifying metal-bearing solutions, and recovery of metals by precipitation and electrolytic processing will be discussed.
Credits: 4.0
Lec-Rec-Lab: (4-0-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2007-2008 academic year
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): CH 1120
CM 4850 - CM Process Analysis & Design 1
Technical and economic evaluation of chemical processes and operations. Applies material and energy balances, flowsheets, energy utilization, and optimization to process systems. Requires use of cost estimating and economic evaluation techniques. The optimization project requires a series of memoranda progress reports, a formal final report, and an oral presentation.
Credits: 2.0
Lec-Rec-Lab: (2-0-0)
Semesters Offered: Fall
Pre-Requisite(s): CM 3120 and CM 3230 and CM 3410

CM 4851 - CM Design Laboratory 1
Discusses open-ended problems in chemical engineering design.
Credits: 1.0
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Fall
Pre-Requisite(s): CM 4850(C)

CM 4860 - CM Process Analysis & Design 2
Applies technical and economical techniques to the development of a chemical process into an optimized design. Uses process synthesis techniques and market research to develop a conceptual design for a proposed new venture. The AIChE National Design Problem is required of each student as a capstone experience.
Credits: 3.0
Lec-Rec-Lab: (2-0-0)
Semesters Offered: Spring
Pre-Requisite(s): CM 4850 and CM 4851

CM 4861 - CM Design Laboratory 2
Discusses open-ended problems in chemical engineering design.
Credits: 1.0
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Spring
Pre-Requisite(s): CM 4850(C)

CM 4900 - Interdisciplinary Design 1
Focuses on an interdisciplinary chemical engineering design project. (Senior project ready as defined by major substitutes for prerequisites.)
Credits: 3.0
Lec-Rec-Lab: (0-1-6)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior
Pre-Requisite(s): CM 3120 and CM 3230 and CM 3310 and CM 3510

CM 4910 - Interdisciplinary Design 2
Focuses on an interdisciplinary chemical engineering design project. (Senior project ready as defined by major substitutes for prerequisites.)
Credits: 3.0
Lec-Rec-Lab: (0-1-6)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior
Pre-Requisite(s): CM 3120 and CM 3230 and CM 3310 and CM 3510

CM 4955 - Process Control Laboratory
Material discussed in CM3310 applied to laboratory experiments to illustrate, by actual practice, the principles of feedback control systems using digital computers. Discusses advanced control concepts: model predictive control and statistical process control. Laboratory experiments involve signal processing, development of a proportional-integral-derivative controller, and tuning of direct digital controllers.
Credits: 3.0
Lec-Rec-Lab: (2-0-3)
Semesters Offered: On Demand
Pre-Requisite(s): CM 3310

CM 4990 - Special Topics in CM
Covers chemical engineering topics not included in regular courses, which may include biochemical engineering, design of biochemical reactions, composite materials, and numerical analysis of transport processes.
Credits: variable to 3.0; Repeatable to a Max of 12
Semesters Offered: On Demand
Restrictions: Permission of instructor required

Construction Management
CMG 1000 - Introduction to Construction Management
Introduction to the construction management profession, current issues and trends in residential and commercial construction industries. Focuses on developing problem-solving skills, construction computational skills, verbal, written, and graphical communication skills.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Fall

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: Spring
Pre-Requisite(s): PH 1140

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 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: Fall

CMG 2265 - Construction Quantity Survey
An introduction to the interpretation of construction drawings to perform quantity take-offs. Emphasis is on the civil and architectural components of building construction, with some discussion of other elements.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): CMG 1000 and CMG 2140

CMG 3200 - Site Planning and Development
Land development methods including site analysis, survey layout, alignment and control, earthwork, sewers, storm water, and underground utilities. Includes 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): 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 MET 2120 or ENG 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
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: Fall
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: On Demand
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): BA 2500

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, jobsite 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 4210

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 2330 or BA 2300 and EC 3400

CMG 4400 - Construction Safety Management
Focuses on the needs of modern construction professionals and on the requirements set forth by OSHA and other regulatory agencies relating specifically to construction.

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 4120 and CMG 4120 and CMG 4210 and CMG 4210

CMG 4999 - Professional Practice Seminar
Provides a review of the latest developments in the construction management profession through participation in student chapter activities of NAHB and AGC.

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): Computer Engineering, Electrical Engineering, Computer Science, Computer Systems Science, Software Engineering
Pre-Requisite(s): 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 Computer Science I
Starting point of the computer science programs. A high-level, object-oriented programming language is introduced as a problem-solving tool. Topics include design, coding, documentation, debugging, and testing of programs. Programming assignments are given in both a closed lab setting and as homework.

Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Fall, Spring, Summer
Pre-Requisite(s): MA 1032(C) or MA 1031(C)

CS 1122 - Introduction to Computer Science II
Continuation of CS 1121. Topics include data abstraction, class hierarchies and polymorphism, list, stack and queue data structures, informal complexity-based algorithm and data structure choices, and recursion. Homework programming assignments are given. Not open to students with credit in CS1129.

Credits: 2.0
Lec-Rec-Lab: (0-2-0)
Semesters Offered: Fall, Spring, Summer
Pre-Requisite(s): CS 1121

CS 1129 - Introduction to Computer Science II in C++
Continuation of CS1121. Topics include data abstraction, class hierarchies and polymorphism, list, stack and queue data structures, informal complexity-based algorithm and data structure choices, and recursion. The C and C++ programming languages are presented and used. Not open to students with credit in CS1122.

Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring
Pre-Requisite(s): CS 1129

CS 1311 - Computer Science I
An alternative starting point of the computer science programs for students with some programming experience, combining material from CS1121 and CS1122, offered at an accelerated pace. Homework programming assignments are given.

Credits: 4.0
Lec-Rec-Lab: (0-4-0)
Semesters Offered: Fall, Spring
Pre-Requisite(s): Permission of department required

CS 1712 - Object Oriented Design
Principles of object oriented design. Includes the software life cycle and unit testing. Students are required to design, unit test, implement, and final test a relatively large project.

Credits: 1.0
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Fall, Spring
Pre-Requisite(s): CS 1121 or CS 1131

CS 2099 - Special Topics in Computer Science
Special topics in computer science offered on occasion based on student and faculty demand and interest.

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

CS 2311 - Discrete Structures
Presents fundamental concepts in discrete structures that are used in computer science. Topics include sets, trees, graphs, functions, relations, recurrences, proof techniques, logic, combinatorics, and probability.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring, Summer
Pre-Requisite(s): (CS 1122 or CS 1131) and (MA 1160 or MA 1161 or MA 1135 or MA 1140)

CS 2321 - Data Structures
Presents fundamental concepts in data structures. Topics include ADTs (trees, priority queues, dictionaries and graphs) and their implementations, algorithm analysis, sorting and text processing. Programming projects are designed to apply these topics.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring
Pre-Requisite(s): CS 1122

CS 3090 - Special Topics in Computer Science
Special topics in computer science offered on occasion based on student and faculty demand and interest.
Credits: variable to 3.0; May be repeated
Semesters Offered: On Demand
Restrictions: Permission of instructor required

CS 3141 - Team Software Project
Introduction to the development of large software projects. Presents examples of software design, quality assurance techniques, and test-case design in conjunction with a significant team project involving design, test, and code documentation as well as user documentation. Other topics include teamwork, user interfaces, social and professional responsibility.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring
Pre-Requisite(s): CS 2141 and CS 2311

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

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

CS 3421 - Computer Organization
Introduction to the logical structure of computers, including the fundamentals of logic design, information storage and manipulation, control, input/output, and assembly language programming. Topics include a review of current hardware technology, combinational and sequential logic, arithmetic, datapaths, hard-wired control, interrupts, caches, virtual memory, and an introduction to pipelining.
Credits: 4.0
Lec-Rec-Lab: (0-4-0)
Semesters Offered: Fall, Spring
Pre-Requisite(s): CS 2311

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

CS 3621 - Computer Graphics: Elementary Geometric Objects and Processing
Topics include the creation, representation and manipulation of geometric objects. Surveys major paradigms of building shapes, including polyhedra, curved solids, curves, and surfaces. Covers classical computational geometry topics such as convex hulls and tessellations, algorithm robustness, and the impact of finite precision arithmetic on geometric computing. Applications discussed.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): MA 2160 and (MA 2330 or MA 2320 or MA 2321) and CS 2141

CS 3911 - Introduction to Numerical Methods with FORTRAN
Topics include floating point arithmetic, sources of numerical error, Taylor polynomials, solution of linear systems and nonlinear equations, interpolation, numerical integration, and numerical solution of differential equations. FORTRAN 90 topics include data types, control flow, arrays, procedures, pointers and dynamic data structures, I/O, and modules. Numerical algorithms will be coded.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): (MA 1160 or MA 1161) and (MA 2320(C) or MA 2321(C) or MA 2330(C)) and CS 2321

CS 4000 - Senior Seminar
Topics include ethical models, legal issues, privacy and security, social responsibility, professional responsibility and service, and the future of computing.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior
Pre-Requisite(s): CS 3141

CS 4099 - Special Topics in Computer Science
Special topics in computer science offered on occasion based on student and faculty demand and interest.
Credits: variable to 4.0; May be repeated
Semesters Offered: On Demand
Restrictions: Permission of instructor required

CS 4099 - Directed Study in Computer Science
Students study one or more special topics in computer science under the direction of one or more faculty members.
Credits: variable to 4.0; Repeatable to a Max of 6
Semesters Offered: Fall, Spring
Restrictions: Permission of instructor required

CS 4121 - Programming Languages
A discussion of the concepts underlying programming languages. Topics include programming paradigms; language criteria (including syntax, semantics, run-time behavior, and implementation issues); data, procedure, functional, and control abstraction; functional programming; and logic programming.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring
Pre-Requisite(s): CS 1721 and CS 2321 and CS 3311

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

CS 4311 - Introduction to Computation Theory
Provides deeper insight into the power of computing using various models of computation. Topics reviewed include proof techniques, finite automata, regular languages, pushdown automata, and context-free languages. Topics covered include Turing machines and their variants, the Halting Problem and decidability, Rice's theorem, computability, time complexity, reducibility, NP-completeness, space complexity, machine self reference, recursion and fixed point theorems, s-m-n theorem.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): CS 3311

Undergraduate Course Descriptions, 2007-08, Page 23 of 86
CS 4321 - Introduction to Algorithms
Fundamental topics in algorithm design, analysis, and implementation. Analysis fundamentals include asymptotic notation, analysis of control structures, solving recurrences, and amortized analysis. Design and implementation topics include sorting, searching, and graph algorithms. Design paradigms include greedy algorithms, divide-and-conquer algorithms, and dynamic programming.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring
Pre-Requisite(s): CS 2311 and CS 1721 and CS 2321

CS 4331 - Introduction to Parallel Programming
Introduction to developing parallel programs and solving problems using multiple concurrent processes. Shared memory and message passing paradigms are studied. Topics include conceptual models of parallel programming, basic analysis of parallel languages, parallel computer architecture, domain decomposition, and load balancing. Traditional computer science applications and numerical applications are also studied.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Pre-Requisite(s): CS 3421 and CS 4321

CS 4411 - Introduction to Operating Systems
Presents topics on program representation and execution, operating systems, process and threads, process scheduling, memory management, and file systems. Programming homework is required.
Credits: 4.0
Lec-Rec-Lab: (0-4-0)
Semesters Offered: Fall, Spring
Pre-Requisite(s): CS 2141 and CS 3421

CS 4421 - Database Systems
Topics include goals of database management; data definition; data models; data normalization; data retrieval and manipulation; security, integrity, and privacy measures; file, data, and storage organization; object-database systems; and parallel and distributed databases. Surveys a number of general database systems and examines in detail at least one database system.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): CS 4411 or CS 4321

CS 4431 - Computer Architecture
Architecture of high-performance parallel computer systems. Introduces various forms of parallelism, such as multiple functional units, pipelining, multiprocessors, and processor arrays. Also covers interleaved memory, caching, and interconnection networks. Includes analytic and simulation models of architectural features that implement or support parallel processing.
Credits: 4.0
Lec-Rec-Lab: (0-3-3)
Semesters Offered: Fall
Pre-Requisite(s): CS 3421

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

CS 4461 - Computer Networks
Computer network architectures and protocols: design and implementation of datalink, network, and transport layer functions. Introduction to the Internet protocol suite and to network tools and programming.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): CS 4321 and CS 4411

CS 4471 - Computer and Network Security
Development of administration of secure software systems. Topics include principles of software development, practical cryptography, program security, operating system security, network security, database security, administration, legal and ethical issues.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): CS 4461 and MA 3203

CS 4481 - Computer and Network Performance Analysis
Analysis of the performance of computer systems. Topics include measurement techniques and tools, probability theory and statistics, experiment design and analysis, simulation, queuing models. Course includes a significant experimental component.
Credits: 4.0
Lec-Rec-Lab: (0-3-3)
Semesters Offered: Spring
Pre-Requisite(s): CS 4411 and MA 2720

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

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

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

CS 4750 - Teaching Methods in Computer Science
Provides teaching methods, models, and experiences for teaching computer science in secondary schools. Topics discussed include teaching methods, learning, security and maintenance of equipment, professional journals, ethics, legal issues, diversity, and problem solving. Requires admission to the Teacher Education Program.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Restrictions: Permission of department required; May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior
Pre-Requisite(s): ED 4700

CS 4760 - Human-Computer Interactions
Principles of design and implementation of human-computer interfaces (HCI). Topics include: HCI design principles, tools and theory. Students receive direct experience with the design, implementation, and evaluation of human-machine interfaces and interactions.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): CS 4121

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

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

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

CS 4811 - Artificial Intelligence
Fundamental ideas and techniques that are used in the construction of AI problem solvers. Topics include knowledge representation, problem solving, heuristics, search heuristics, inference mechanisms, expert systems, and language understanding.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): CS 4121
Economics

EC 3001 - Principles of Economics
An introduction to economics. The microeconomics portion covers consumer choice, the firm, value and price theory, and distribution theory. The macroeconomics portion covers national income analysis, fiscal policy, money and monetary policy, the commercial banking system, and the Federal Reserve System.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring, Summer
Pre-Requisite(s): UN 2002(C) and (MA 1032 or MA 1140(C) or MA 1160(C) or MA 1161(C) or MA 1135(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 3001 and UN 2002 and (MA 1135 or MA 1140 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 3001 or EC 2002 or EC 2003 and (UN 2002 or UN 1002 or UN 1003)

EC 3030 - Game Theory/Strategic Behavior
The study of strategic situations involving the interactions of individuals. Modeling techniques are applied to game situations faced in business, entertainment, politics, and the daily routine of life.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Summer - Offered alternate years beginning with the 2000-2001 academic year
Pre-Requisite(s): EC 3001 or EC 2002 or EC 2003 and UN 2002

EC 3100 - International Economics
Introduction to international economics, including balance of payments, accounting, foreign exchange markets, international trade theory, barriers to trade, trade and development, regional economic integration, and current U.S. international economic issues.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring, Summer
Pre-Requisite(s): EC 3001 or EC 2002 or EC 2003 and UN 2002

EC 3110 - International Economics
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, Spring, Summer
Pre-Requisite(s): EC 3001 or EC 2002 or EC 2003 and UN 2002

EC 3200 - History of Economic Thought
Development of economic ideas from the mercantilists and physiocrats through modern supply side economics, including economists such as Smith, Ricardo, Marx, Keynes, Mill, and Friedman.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: On Demand
Pre-Requisite(s): EC 3001 or EC 2002 or EC 2003 and (UN 2002 or UN 1002 or UN 1003)

EC 3300 - Industrial Organization
The study of strategic situations involving the interactions of individuals. Modeling techniques are applied to game situations faced in business, entertainment, politics, and the daily routine of life.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Summer - Offered alternate years beginning with the 2000-2001 academic year
Pre-Requisite(s): EC 3001 or EC 2002 or EC 2003 and UN 2002

EC 3302 - Industrial Organization
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 3001 and UN 2002 and (MA 1135 or MA 1140 or MA 1160 or MA 1161)

EC 3400 - Economic Decision Analysis
For students who wish to take 3 credits of economic decision analysis in one semester rather than one or two of the individual modules. EC3401 is the first ten weeks of the course; EC3402 is the last five weeks. See EC3401-3 for contents.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring, Summer
Pre-Requisite(s): EC 3001 or EC 2002 and UN 2002

EC 3500 - Public Economics
Economic analysis of how democratic governments generate revenue (primarily taxation) and make expenditure decisions and how such decisions impact the welfare of individuals. Topics include market failures, voting processes, income redistribution programs, efficiency and incidence of taxation.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2001-2002 academic year
Pre-Requisite(s): (EC 3001 or EC 2002 or EC 2003) and UN 2002

EC 3700 - Labor/Human Resource Economics
Economic analysis of labor markets and human resources. Topics include the supply and demand for labor, wage determination, human capital theory, returns to education and training, causes of wage differentials, and economic effects of discrimination.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall - Offered alternate years beginning with the 2001-2002 academic year
Pre-Requisite(s): EC 3001 or (EC 2002 and EC 2003) and UN 2002 and (BA 2100 or MA 2710 or MA 2720 or MA 3710)

EC 4000 - Senior Seminar in Economics
A senior capstone seminar in which students discuss and conduct research under the guidance of several faculty members.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): EC 3001 or (BA 2100 or MA 2710 or MA 2720 or MA 3710)

EC 4200 - Econometrics
Introduces techniques and procedures to estimate and test economic and financial relationships developed in business, economics, social and physical sciences.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): (EC 3001 or EC 3002 or EC 3003) and (BA 2100 or MA 2710 or MA 2720 or MA 3710) and (MA 1135 or MA 1140 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: Spring
Pre-Requisite(s): (EC 3003 or BA 3400) and UN 2002

EC 4600 - Natural Resource and Environmental Economics
Examines economic and policy issues related to the supply and use of natural resources and to the environmental problems related to their use. Resources studied include minerals, energy, agriculture, forests, fisheries, wildlife, and water. Policy issues include efficiency, benefit cost analysis, U.S. environmental policy, and international concerns.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Pre-Requisite(s): (EC 3001 or BA 3400) and UN 2002

EC 4620 - Energy Economics
Introduction to the institutional, technical, and economic issues of the production and use of energy resources, including petroleum, natural gas, coal, nuclear, electric utilities, and alternative energy sources. Applies economic analysis to industrial and policy problems of the supply, distribution, and use of energy resources, including environmental and social consequences.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Pre-Requisite(s): (EC 3001 or BA 3400) and UN 2002

EC 4630 - Mineral Industry Economics
Studies the role of minerals and metals in society and the economics of their use. Applies economic principles to examine the supply, demand, markets, and foreign trade for important minerals and metals. Examines the effects of government policies on the minerals industries. Requires a technical report.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring
Pre-Requisite(s): EC 3001 and UN 2002

EC 4631 - Food Industry Economics
Studies the role of agriculture and food in society and the economics of their use. Applies economic principles to examine the supply, demand, markets, and foreign trade for important agriculture and food products. Examines the effects of government policies on the agriculture and food industries. Requires a technical report.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring
Pre-Requisite(s): EC 3001 and UN 2002
EC 4700 - Economics of Health Care
Economic analysis of the health care sector: organization, demand and supply factors, pricing practices, financing mechanism, public vs. private, impact of third party, medical school funding and admission policy, insurance and prepayment, and health and economic development.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: On Demand
Pre-Requisite(s): EC 3001 and UN 2002

EC 4800 - Economics of Technological Change
Economic issues related to technological change: role of technological change in economic growth, economics of research and development, processes of invention and innovation and their relation to market structure, diffusion of new technology and its impact on markets, economic aspects of intellectual property, and public policy toward technological change.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: On Demand
Pre-Requisite(s): EC 3001 and UN 2002

EC 4900 - Research
Under the general guidance of a faculty member, students read, conduct research, and prepare reports and papers as required.
Credits: variable to 4.0; Repeatable to a Max of 6
Semesters Offered: On Demand
Pre-Requisite(s): EC 3001 or EC 2002 or EC 2003

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

Education

ED 2010 - Field Study in Education: Elementary School
Observations in an elementary school, offering relevant school experience to help clarify career goals.
Credits: 1.0
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring
Restrictions: Permission of department required

ED 2020 - Field Study in Education: Secondary School
Observations in a secondary school, offering relevant school experience to help clarify career goals.
Credits: 1.0
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring
Restrictions: Permission of department required

ED 3100 - Instructional Technology
Provides the development of knowledge and skills required to make use of information and communication technologies as instructional tools. Use of instructional technology will be considered within a context of relevant research and theory pertaining to human learning. Examines various technologies used to produce, present, and distribute instruction.
Credits: 2.0
Lec-Rec-Lab: (0-2-0)
Semesters Offered: Fall, Spring, Summer
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore

ED 3110 - Psychological Foundations of Learning
The course examines how human beings grow and learn with major emphasis on the early adolescent and adolescent. Psychological basis of educational procedures and practices are established with special reference to learning disorders, gifted children, and culturally diverse classrooms.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): PSY 2000 and UN 2002

ED 3210 - Foundations of Education
Contemporary issues in education from historical, philosophical, sociological and legal perspectives. Emphasizes the structure/function of U.S. education as well as exceptional children, especially the handicapped and culturally different. This course is one component of the Teacher Education Early Block. Requires admission to teacher education program.
Credits: 2.0
Lec-Rec-Lab: (0-2-0)
Semesters Offered: Fall, Spring
Restrictions: Permission of department required; May not be enrolled in one of the following Class(es): Freshman, Sophomore
Co-Requisite(s): ED 3110, ED 3410
Pre-Requisite(s): UN 1002 or UN 1003

ED 3410 - Methods of Teaching English
Application of learning and instructional theories and practice to the teaching of English. Emphasizes methods, materials, and media used to teach adolescents. Requires admission to teacher education program or permission of instructor.
Credits: 4.0
Lec-Rec-Lab: (0-3-3)
Semesters Offered: Fall, Spring
Restrictions: Permission of department required

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: 1.0
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring, Summer
Pre-Requisite(s): UN 2002

ED 3511 - Communicating Science II
Students will make presentations in local K-8 classrooms and/or at evening family science nights conducted at area schools. Classroom lectures will focus on the rationale for interacting with schools and communities as a professional, presentation skills, effective teaching techniques, learning styles, classroom management techniques, and model hands-on learning techniques.
Credits: 1.0
Lec-Rec-Lab: (0-0-1)
Semesters Offered: Fall, Spring, Summer
Pre-Requisite(s): UN 2002

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

ED 4140 - Methods of Teaching English
Application of learning theories and national and state professional standards to the teaching of English. Emphasizes methods, materials, and media used to teach adolescents. Requires admission to teacher education program or permission of instructor.
Credits: 4.0
Lec-Rec-Lab: (0-3-3)
Semesters Offered: Fall
Restrictions: Permission of department required
Pre-Requisite(s): ED 3110 and ED 3210 and ED 3410 and ED 4700(C)

ED 4150 - Literacy in the Content Areas
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
Restrictions: Permission of instructor required
ED 4700 - Fundamentals of Instruction
Study of key areas of instruction in preparation for student teaching. Emphasis is placed on lesson planning, classroom management, and student assessment and evaluation. Requires admission to the teacher education program by the Department of Education.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring
Restrictions: Permission of department required; May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior
Pre-Requisite(s): ED 3110 and ED 3210 and ED 3410

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

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

ED 4750 - Teaching Methods in Computer Science
Provides teaching methods, models, and experiences for teaching computer science in secondary schools. Topics discussed include teaching methods, learning, security and maintenance of equipment, professional journals, ethics, legal issues, diversity, and problem solving. Requires admissions to the Teacher Education Program.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring
Restrictions: Permission of department required
Pre-Requisite(s): ED 4700

ED 4790 - Curriculum and Methods of Teaching Health and Physical Education
A course in program planning and techniques of teaching physical education and health education in the secondary schools. Includes critical analysis of methods now in use in physical education and health education, their inter-relationship and criteria for evaluation or programs. Unit planning, daily lesson plans, teaching aids, materials for the program included.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Fall, Spring
Restrictions: Permission of department required; Must be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): BL 3970 and EH 4420 and EH 4301 and EH 4300 and ED 4150

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: Fall, Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): UN 2002

ED 4910 - Directed Teaching
Knowledge of human growth and learning theories, methods and materials, and individual differences applied to classroom settings conducted under the supervision of an experienced middle or secondary school teacher. Requires admission to teacher education program.
Credits: 12.0
Lec-Rec-Lab: (0-0-36)
Semesters Offered: Fall, Spring
Restrictions: Permission of department required; May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior
Pre-Requisite(s): ED 3100 and ED 4700 and (HU 4140(C) or ED 4710(C) or SS 4020(C) or ED 4740)

ED 1000 - Explorations in Computing
Introduction to the full spectrum of computing disciplines offered at Michigan Tech. Topics include an introduction to technical aspects of the various disciplines, degree choices, career opportunities, ethical issues, and the impact of computers on modern society.
Credits: 1.0
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Major(s): Computer Engineering, Electrical Engineering, Engineering Undeclared, Computer Science, Computer Systems Science, Software Engineering

EE 2110 - Electric Circuits
Introduction to linear circuit analysis, circuit elements, network theorems, steady-state sinusoidal response, transient response using LaPlace transforms, and frequency response.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring, Summer
Pre-Requisite(s): EE 2150 and (MA 3520 or MA 3521 or MA 3530 or MA 3560)

EE 2150 - Introduction to Signal Processing
Introduces the mathematical modeling techniques used in the design and analysis of analog and digital signal-processing systems. Topics include analog and digital signal processing, spectral representations, filtering, frequency response, and the Fourier and Z-transforms. Applications include communication, control, audio, video, and image processing systems.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring, Summer
Pre-Requisite(s): MA 2160 and (CS 1121 or CS 1131)

EE 2171 - Digital Logic
Introduces analysis, design, and application of digital logic. Includes Boolean algebra, binary numbers, logic gates, combinational and sequential logic, storage elements, schematic and hardware-description-language based synthesis.
Credits: 2.0
Lec-Rec-Lab: (2-0-0)
Semesters Offered: Spring
Pre-Requisite(s): MA 3521 and PH 2200(C)

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

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

EE 3010 - Circuits and Instrumentation
Designed for nonmajors. Covers the principles of electrical and electronic measurements, including dc, ac, semiconductor devices, amplifiers, and filtering.
Credits: 3.0
Lec-Rec-Lab: (2-0-2)
Semesters Offered: Fall, Spring, Summer
Restrictions: May not be enrolled in one of the following Major(s): Computer Engineering, Electrical Engineering

EE 3120 - Electric Energy Systems
An overview of the generation and utilization of electrical energy. Covers three-phase circuits, transformers, photovoltaics, batteries, electromechanical energy conversion, and an overview of electric power systems, including economic issues.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring
Pre-Requisite(s): EE 2110 or EE 3010
EE 3130 - Electronics
Covers the fundamentals of electronic circuits and devices.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring, Summer
Pre-Requisite(s): EE 2110 or EE 3010

EE 3140 - Electromagnetics
Covers basic principles of engineering electromagnetics with an emphasis on Maxwell's equations.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring
Pre-Requisite(s): PH 2200 and MA 3160

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

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

EE 3173 - Hardware/Software System Integration
Covers the integration of hardware and software into a complete working system. Includes design and construction of I/O devices for microprocessor- or microcontroller-based systems, communication and bus protocols, programming in assembler language and in "C", system integration and testing. Also covers the use and integration of FPGAs using both schematic capture and HDL design tools.
Credits: 4.0
Lec-Rec-Lab: (0-3-3)
Semesters Offered: Fall, Spring
Restrictions: Must be enrolled in one of the following Major(s): Computer Engineering
Pre-Requisite(s): EE 2304 and EE 3130 and CS 2141 and CS 3421

EE 3175 - Computer Architecture with Modeling and Simulation
Covers the theory and practice of using computer-aided modeling and simulation as tools for digital system design. Topics are drawn from both discrete event simulation and stochastic modeling of system performance and reliability, including Monte Carlo approaches, queuing models, and Markov models. Includes system modeling programming assignments.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring
Restrictions: Must be enrolled in one of the following Major(s): Computer Engineering
Pre-Requisite(s): EE 2304 and EE 3130 and CS 2141 and CS 3421

EE 3190 - Optical Sensing and Imaging
Optical sensing techniques, including imaging and non-imaging systems.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Pre-Requisite(s): EE 2190 or EE 3160

EE 3211 - Introduction to Motor Drives
Provides a thorough understanding of how electric motor drives can be used to control speed and position in various applications. Course is equally useful for nonmajors.
Credits: 4.0
Lec-Rec-Lab: (0-3-2)
Semesters Offered: Spring
Pre-Requisite(s): EE 2110 or EE 3010

EE 3291 - Light Wave Devices
Light wave propagation in optical crystals and fibers, detection and creation of light in semiconductors.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Major(s): Electrical Engineering, Applied Physics, Physics; Must be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): EE 2190 or EE 3140 or PH 2400

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

EE 3306 - Electronic Design with Microprocessor Applications
Covers the design and analysis of electronic circuits with microprocessor applications
Credits: 1.0
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring, Summer
Restrictions: Must be enrolled in one of the following Major(s): Electrical Engineering; May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): EE 3305 and EE 3130 and EE 3170

EE 3391 - Photonics Laboratory
Basic optics lab experience covering geometrical optics, fiber optics, interferometry and diffraction. Optical measurements and laser safety are also covered.
Credits: 1.0
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Major(s): Electrical Engineering
Pre-Requisite(s): EE 2190 and EE 3190

EE 3805 - Electrical Engineering Project
A project in electrical engineering. An individual student or a group of students complete a mutually agreed upon project in consultation with a faculty member
Credits: variable to 3.0; Repeatable to a Max of 6; Graded Pass/Fail Only
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of instructor and department required

EE 3970 - Computer Engineering Professional Development
Introduces professional topics such as team organization, plagiarism, ethics, IEEE writing, speaking and citation styles, experimental design, data gathering and analysis, software instrumentation, benchmarking, and industry standards. Individual and team projects require integration of knowledge across prerequisite course boundaries.
Credits: 2.0
Lec-Rec-Lab: (2-0-0)
Semesters Offered: Fall, Spring
Restrictions: Must be enrolled in one of the following Major(s): Computer Engineering
Pre-Requisite(s): EE 2190 and EE 3190

EE 4221 - Power System Analysis 1
Complex Power flow in circuits and the effects of real and reactive power flow on a system; transformer and load representations in power systems; power transmission line parameters and steady-state operation of transmission lines; the per unit system; development of the bus admittance matrix; power flow.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): EE 3120

EE 4222 - Power System Analysis 2
Topics covered include symmetrical components; symmetrical faults; unbalanced faults; generating the bus impedance matrix and using it in fault studies; power system protection; power system operation; power system stability.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): EE 4221

EE 4223 - Power System Protection
Real-time monitoring and protection of modern power systems. Secure and reliable operation of radial and grid systems. Protection of transmission lines, buses, generators, motors, transformers, and other equipment against disturbances.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2008-2009 academic year
Pre-Requisite(s): EE 4221 and EE 4222(C)

EE 4224 - Power System Protection Lab
Theory-based application of software and hardware used for power system protection. Fault simulations, protective relay settings and coordination, and test operation of relays under static, dynamic, and transient conditions.
Credits: 1.0
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Spring - Offered alternate years beginning with the 2008-2009 academic year
Pre-Requisite(s): EE 4223(C)
EE 4225 - Distribution Engineering
Modeling and analysis of electrical distribution systems; load characteristics, load modeling, unbalanced three-phase overhead and underground line models, and distribution transformers. Analysis of over current protection, voltage drop, and power quality.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2005-2006 academic year
Restrictions: Must be enrolled in one of the following Major(s): Computer Engineering, Electrical Engineering
Pre-Requisite(s): EE 4221

EE 4231 - Physical Electronics
Device physics and physical models of the most basic solid-state device structures. Major topics include the terminal characteristics and their physical origin, device design, and device applications.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): EE 3130

EE 4232 - Electronic Applications
Study of electronic circuits under small- and large-signal conditions. Typical topics include analysis and design of power and RF amplifiers, feedback circuits, oscillators, timing circuits, Schmitt triggers, non-linear models of semiconductor devices, the factors that limit switching speed, the switching of reactive elements, and DC-DC converters.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): EE 3130

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

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

EE 4250 - Communication Theory
Introduces the mathematical theory of communication science. Topics include baseband and digital signaling, bandpass signaling, AM and FM systems, bandpass digital systems, and case studies of communication systems.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Pre-Requisite(s): EE 3160 and MA 3720

EE 4255 - Wireless Communications
Principles of wireless communication systems. Projects may include cell phones, computer networks, paging systems, satellite communications, radio, television and telemetry.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): EE 4250

EE 4256 - Fourier Optics
Analysis and modeling of diffraction effects in optical systems, emphasizing frequency-domain analytic and computational approaches. Presents wave propagation, imaging, and optical information processing applications.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Major(s): Electrical Engineering
Pre-Requisite(s): EE 2190 or EE 3140

EE 4257 - Digital Image Processing
Image formation, enhancement and reconstruction. Applications in medical imaging, computer vision, and pattern recognition.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Fall
Pre-Requisite(s): EE 4215 and EE 4262

EE 4261 - Classical Control Systems
Mathematical formulation of control problems (both transfer function and state-variable descriptions); analysis of feedback control systems (stability, transient performance, steady-state error, sensitivity, etc.); design using frequency response, root locus, state-variable methods; analog and digital simulation and computation; and experiments with physical systems.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Fall
Pre-Requisite(s): EE 4215 and EE 4262

EE 4262 - Digital and Non-linear Control
Digital control system design and analysis (Z-transforms, difference equations, and the discrete-time state model); introduction to nonlinear systems (equilibrium states, linearization, phase plane analysis, and describing function analysis); discrete-event controller design (state-transition techniques, relay ladder logic, and Petri nets); introduction to hierarchic systems; and experiments with physical systems.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Fall
Pre-Requisite(s): EE 4215 and EE 4262

EE 4271 - VLSI Design
Design of VLSI circuits using CAD tools. Analysis of physical factors affecting performance.
Credits: 4.0
Lec-Rec-Lab: (0-3-2)
Semesters Offered: Fall, Summer
Pre-Requisite(s): EE 2171 and EE 3130

EE 4272 - Computer Networks
Focuses on the fundamental network architecture concepts and the core design principles and issues in the emerging communication/data networks. The course systematically gives students the complete picture of data and computer networks.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): EE 4215 and (MA 3710 or MA 3720)

EE 4290 - Optical Communication
Fundamentals of fiber optics communications, including sources, transmission media, detectors, signal processing, and networking.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Major(s): Electrical Engineering
Pre-Requisite(s): EE 3291

EE 4411 - Engineering Electromagnetics
A mathematically rigorous study of dynamic electromagnetic fields, beginning with Maxwell's equations. Topics include scalar and vector potentials, waves, and radiation.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Pre-Requisite(s): EE 3140
EE 4412 - Radar Remote Sensing
Fundamentals and overview of radar systems. Radar cross-section and detectability; ambiguity function; pulse compression techniques; spectrum estimation for underspread and overspread targets; TDOA: interferometry; multi-static and passive systems. Aperture synthesis (SAR) and antenna theory if time allows.
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): EE 3140 and EE 3160

EE 4441 - Laser Types, Laser Design, Modeling Techniques, and Nonlinear Optics
Survey of laser types and analysis of the common physical and engineering principles, including energy states, inversion, gain, and broadening mechanisms. Design issues include resonators, packaging, cooling, pulsed power, and safety. Students will construct a computational model that predicts laser performance. Nonlinear optics and selected applications also covered.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Pre-Requisite(s): EE 3140

EE 4800 - Special Topics in Electrical Engineering
Covers specific topics in electrical engineering.
Credits: variable to 4.0; Repeatable to a Max of 6
Semesters Offered: On Demand
Restrictions: Permission of instructor and department required

EE 4805 - Electrical Engineering Project
A project in electrical engineering. An individual student or a group of students complete a mutually-agreed-upon project in consultation with a faculty member.
Credits: variable to 3.0; Repeatable to a Max of 6; Graded Pass/Fail Only
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of instructor and department required

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

EE 4900 - Design Fundamentals
The design process. Includes team design activities and studies project management.
Credits: 1.0
Lec-Rec-Lab: (1-0-0)
Semesters Offered: Fall
Pre-Requisite(s): EE 4901(C)

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

EE 4910 - EE Design Project 2
The second semester of a program of study in which a group of students work on an engineering design project in consultation with a faculty member. (Senior project ready as defined by major substitutes for prerequisites)
Credits: 3.0
Lec-Rec-Lab: (0-1-6)
Semesters Offered: Spring
Pre-Requisite(s): EE 4901

Electrical Engineering Technology

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

EET 1120 - Circuits I
Defines resistance, voltage, current, energy, and power, followed by DC network analysis and network theorems. Includes the analysis of transients in capacitive and inductive networks. Lab exercises use electronic test equipment to analyze circuits constructed from schematics.
Credits: 4.0
Lec-Rec-Lab: (0-3-2)
Semesters Offered: Fall, Spring
Restrictions: Must be enrolled in one of the following Major(s): Computer Network & System Admin
Co-Requisite(s): EET 2412
Pre-Requisite(s): EET 1411 and (MA 1031(C) or MA 1032(C))

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

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

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

EET 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: Fall
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: Fall, Spring
Pre-Requisite(s): EET 2120

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

EET 2241 - Structure and Assembly Programming
Introduction to C++ programming and MATLAB for use in solving problems encountered in engineering technology. C++ topics include the basics of syntax and program structure. Focus on the basic capabilities of MATLAB and its programming environment.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Fall
Pre-Requisite(s): EET 2141

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, 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 Admin
Co-Requisite(s): EET 2412
Pre-Requisite(s): EET 1411 and (MA 1031(C) or MA 1032(C))
EET 2412 - Data Communications
Introduction to the fundamentals of basic data communications methods. Topics include digital communications and fiber optics.
Credits: 2.0
Lec-Rec-Lab: (0-2-0)
Semesters Offered: Fall
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 and (MA 1031(C) or MA 1032(C))

EET 3131 - Instrumentation
An investigation of transducers and where they are used. Topics include sensitivity, linearity, hysteresis, process measurements, and position, motion and force measurements.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Spring
Pre-Requisite(s): EET 1411 or EET 2311 or EET 2220

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 2141

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 2142 and 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: Spring
Pre-Requisite(s): EET 2142 and 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: Spring
Pre-Requisite(s): EET 2220

EET 3281 - Electrical Project Development and Troubleshooting
Covers soldering, component layout, printed circuit board artwork, troubleshooting, electrical and environmental factors in design as well as an overview of the practical methods used by industry to process projects. The student designs and fabricates a circuit board and assembles a project.
Credits: 3.0
Lec-Rec-Lab: (0-1-3)
Semesters Offered: Spring
Pre-Requisite(s): EET 2220

EET 3353 - Sensors, Data Acquisition and Control
An introduction to graphical programming in G. National Instruments LabVIEW software is used in learning the fundamentals of graphical programming. Data acquisition and control programs are written, and transducer utilization and signal conditioning studied.
Credits: 3.0
Lec-Rec-Lab: (0-2-3)
Semesters Offered: Spring
Pre-Requisite(s): EET 1411 or EET 2220 or EET 2311 or EE 3010

EET 3341 - Sensor Interface and Control Systems
A basic course in communications systems. Includes information theory, AM receiving and transmission, SSB, frequency and phase angle modulation systems, TV, and frequency synthesis. Also includes system modeling using block diagrams and analysis of typical circuits.
Credits: 4.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): EET 3225

EET 3373 - Introduction to Programmable Controllers
The design of discreet sequential control using programmable logic controllers, PLCs. Relay logic is used to introduce ladder logic and ladder logic is used to program the PLC. Introduces a structured approach to sequential control design. Data acquisition is introduced using BridgeVIEW software.
Credits: 3.0
Lec-Rec-Lab: (0-2-3)
Semesters Offered: Fall
Pre-Requisite(s): EET 2311 or (EET 2120 and EET 2141) or EET 2411

EET 3390 - Power Systems
Study of transmission of electric power from generators to loads, system components, and system performance. Covers basic power systems and their analysis, the per-unit system, faults on power systems, circuit interrupting devices, system instrumentation, automatic protection systems, and safety and grounding.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): EET 2233

EET 3700 - Electrical Power, Machinery, and Programmable Logic Controller Basics
Fundamental steady-state analysis of electrical machinery, including transformers, DC machines, polyphase and single phase AC machines. Relay logic is used to introduce ladder logic and then a transition is made to use ladder logic of a PLC.
Credits: 4.0
Lec-Rec-Lab: (0-3-3)
Semesters Offered: Spring
Restrictions: May be enrolled in one of the following Major(s): Electrical Eng Tech (AAS), Electrical Eng Tech (BS), Electromechanical Eng Tech
Pre-Requisite(s): EET 1411 or EET 2311 or EET 2220 or EE 3010

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, types, electronic system components, and analog-digital conversion; error analysis, hardware and software.
Credits: 3.0
Lec-Rec-Lab: (0-3-3)
Semesters Offered: Spring - Offered alternate years beginning with the 2008-2009 academic year
Pre-Requisite(s): EET 4141 and EET 2220

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: (0-3-0)
Semesters Offered: Fall - Offered alternate years beginning with the 2008-2009 academic year
Pre-Requisite(s): EET 3143
EET 4311 - Advanced Circuits and Controls
This course considers the modeling, design and implementation of basic and advanced process control strategies. Process modeling and dynamics will be considered using LaPlace transform analysis. Control techniques addressed will include feedback, cascade, feedforward, multivariable and model based methods.
Credits: 4.0
Lec-Rec-Lab: (0-3-3)
Semesters Offered: Fall
Pre-Requisite(s): EET 3353 or EET 3131

EET 4367 - Wireless Communications
A continuation of EET3267. Topics include transmission lines, wave propagation, antennas, fiber optics, digital communications, and applications of those ideas to mobile wireless communications systems.
Credits: 4.0
Lec-Rec-Lab: (0-3-3)
Semesters Offered: Spring
Pre-Requisite(s): EET 3367 and (MA 2140 or MA 2160)

EET 4373 - Advanced Programmable Controllers
Using Allen Bradley Micro Logix, SLC500, & PLC-5 programmable controllers, course covers structured programming, Sequential Function Charts, networking, proportional integral differential control, data acquisition and interfacing. The labs will require students to write and troubleshoot complex PLC programs.
Credits: 4.0
Lec-Rec-Lab: (0-2-3)
Semesters Offered: Spring
Pre-Requisite(s): EET 3373

EET 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: (1-0-2)
Semesters Offered: Fall, Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore

EET 4480 - Senior Project II
A capstone course requiring the application of knowledge gained in lower division courses. Projects are normally team oriented, require weekly progress reports, and culminate with a final report and oral presentation.
Credits: 3.0; Repeatable to a Max of 6
Lec-Rec-Lab: (1-0-2)
Semesters Offered: Fall, Spring, Summer
Restrictions: Must be enrolled in one of the following Class(es): Senior
Pre-Requisite(s): EET 4460

EET 4999 - Professional Practice Seminar
A review of the latest developments in electrical engineering technology.
Credits: 1.0; Graded Pass/Fail Only
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Fall, Summer
Restrictions: Must be enrolled in one of the following Major(s): Electrical Eng Tech (BS); Must be enrolled in one of the following Class(es): Senior

Exercise Science & Health

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

EH 1100 - Foundations of Health and Physical Education
Introduction to the fields, career opportunities, and curriculum in health and physical education. Covers historical and social precedents, current problems and controversies. Includes observation.
Credits: 2.0
Lec-Rec-Lab: (2-0-0)
Semesters Offered: Fall

EH 2010 - Principles of Weight Training and Aerobics
Students learn the complimentary roles of aerobics and weight training in a complete fitness program. Emphasis will be placed on implementing a personal fitness approach, encouraging participation for all levels, ages, and experiences, and in a variety of settings.
Credits: 2.0
Lec-Rec-Lab: (1-0-2)
Semesters Offered: Spring

EH 2020 - Introduction to Individual Sports
Students learn to present a variety of individual sports. Emphasis will be placed on various teaching methods and strategies for the sequencing skills, the presentation of skills, skill drills, rules, methods of evaluation, and game situations for teaching in a variety of settings.
Credits: 2.0
Lec-Rec-Lab: (1-0-2)
Semesters Offered: Spring

EH 2029 - Ski Patrol (First Aid)
Second of two-course sequence required for Alpine and Nordic Ski Patrol candidates. Ninety hours of instruction includes three weekends. Requires payment of dues to become member of National Ski Patrol. Certification in National Ski Patrol Outdoor Emergency Care is available upon completion.
Credits: 1.0
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Fall
Pre-Requisite(s): PE 2028

EH 2100 - Principles of Sports Officiating
Theory and practice of officiating various sports common in the community and school setting.
Credits: 2.0
Lec-Rec-Lab: (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: 2.0
Lec-Rec-Lab: (2-0-0)
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.
Credits: 1.0
Lec-Rec-Lab: (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).
Credits: 1.0
Lec-Rec-Lab: (1-0-0)
Semesters Offered: Spring

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-Rec-Lab: (1-0-1)
Semesters Offered: Fall
Restrictions: Permission of department required

EH 3020 - Foundations of Coaching
Practical and relevant information appropriate for beginning and experienced interscholastic coaches. Successful completion of this course will earn a PACE certificate recognized by the state of Michigan.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Fall

EH 3050 - Introduction to Athletic Training
Designed for coaches. Covers first aid, adult CPR, child CPR, and other sport training issues. Students receive appropriate certification cards.
Credits: 3.0
Lec-Rec-Lab: (2-0-1)
Semesters Offered: Fall, Spring
EH 3100 - Exercise Assessment and Prescriptions
Theory and practical aspects of exercise testing and prescription; topics include testing of strength, endurance, cardiovascular endurance, flexibility, body composition, muscle power, and balance with special considerations for arthritis, osteoporosis, dyslipidemia, immunology, and metabolic syndrome.
Credits: 3.0
Lec-Rec-Lab: (2-0-3)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore

EH 3150 - Health of Special Populations
Designed to help students identify and develop effective health education programming that will lend to the reduction of health disparities which exist in special populations. Includes youth, elderly, pregnant, pulmonary disease, vascular disease and musculoskeletal disorders.
Credits: 2.0
Lec-Rec-Lab: (2-0-0)
Semesters Offered: Spring

EH 3200 - Foundations of Kinesiology
The study of the motion of the human body. Examines the physical, biological, social and psychological aspects of physical activity, sports and exercise. Bone, joint and muscle biomechanics are examined as related to sports and physical activity. Applications to the health and fitness professions are discussed.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring

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: 2.0
Lec-Rec-Lab: (1-0-2)
Semesters Offered: Fall

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

EH 3985 - First Aid/CPR
Lecture, demonstration, and practice of first aid knowledge and skills. Adult, child, and infant CPR skills will be covered as well as AED. Offered the first and second half of fall and spring semesters.
Credits: 1.0
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring

EH 4010 - Sports Psychology
Emphasizes the application of psychological principles to the sports setting as they affect teaching styles, individual athletes, and athletic performance.
Credits: 3.0
Lec-Rec-Lab: (0-2-1)
Semesters Offered: Fall, Spring

EH 4070 - Curriculum and Methods of Teaching and Coaching
Students will demonstrate knowledge of skills, tactics and strategies, and sporting principles in planning learning experiences in various physical activities for children K-12, with consideration of appropriate growth, development, and learning. Offered spring semester.
Credits: 3.0
Lec-Rec-Lab: (2-0-1)
Semesters Offered: Spring - Offered alternate years beginning with the 2006-2007 academic year

EH 4080 - Sports & Facility Management
Topics to be included (but not exclusive of) are risk management, administration of personnel, organization, and administrative efficiency in implementing sports programs. Offered spring.
Credits: 2.0
Lec-Rec-Lab: (2-0-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2007-2008 academic year

EH 4090 - Theory of Training
Fundamentals of training, endurance, and sprint athletics. Topics include goal setting, intensities, lactate threshold, oxygen uptake, recovery, periodization, injuries, and nutrition. Offered spring semester.
Credits: 2.0
Lec-Rec-Lab: (1-0-1)
Semesters Offered: Spring - Offered alternate years beginning with the 2006-2007 academic year

EH 4100 - Coaching Practicum
Students seeking coaching endorsement assist with a sport of their choice. Subject to approval of endorsement advisor, students may assist a head coach in season during student teaching; assist MTU head coach in season; assist head coach in season at public/private school or summer camp.
Credits: 2.0
Lec-Rec-Lab: (0-0-4)
Semesters Offered: Fall, Spring
Restrictions: Permission of instructor required
Pre-Requisite(s): EH 4010 and (EH 3020 or EH 4020)

EH 4200 - Sports Nutrition Seminar
Human nutrition as it specifically applies to athletes. Specific needs for proteins, carbohydrates, fats, electrolytes and micronutrients. Use of ergogenic aids is covered. Students will research, write and present orally their findings on nutrition topics.
Credits: 2.0
Lec-Rec-Lab: (2-2-0)
Semesters Offered: Fall, Spring - Offered alternate years beginning with the 2007-2008 academic year
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): BL 2940

EH 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

EH 4300 - Program Administration of Health Education
Organizing and administering the total school health program for secondary schools. Includes health instruction, school health services, and the school health environment with emphasis on legal considerations, public relations, personnel, program facilities, and financial management.
Credits: 2.0
Lec-Rec-Lab: (2-0-2)
Semesters Offered: Spring

EH 4400 - Motor Control
Designed for upper level undergraduates or graduates with a basic neuroscience background. Students learn the basics of how the neural and muscular systems coordinate human movement. This will require an integration of biomechanics, molecular and cellular neurophysiology, cognitive neuroscience, and sensory motor skills.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall

EH 4420 - Motor Learning and Development
Designed for upper level undergraduates or graduates with a basic neuroscience background. Students learn the basics of how humans learn to control muscles and coordinate movement (motor learning), and how motor behavior progressively changes throughout a life cycle (motor development).
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Pre-Requisite(s): EH 4400
EH 4790 - Curriculum and Methods of Teaching Health and Physical Education
A course in program planning and techniques of teaching physical education and health education in the secondary schools. Includes critical analysis of methods now in use in physical education and health education, their inter-relationship and criteria for evaluation or programs. Unit planning, daily lesson plans, teaching aids, materials for the program included.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Fall
Restrictions: Permission of department required; Must be enrolled in one of the following Major(s): Health and Physical Education; Must be enrolled in one of the following Class(es): Senior
Pre-Requisite(s): BL 3970 and EH 4420 and EH 4301 and EH 4300 and ED 4150

EH 4800 - Internship in Health and Physical Education
Empirical experiences in an approved internship site. Provides practical experience in one or more work settings, assisting the senior student in making an appropriate career choice. Students work 100 hours, plus write a paper and make a presentation to the class.
Credits: 3.0
Lec-Rec-Lab: (0-1-4)
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of department required; Must be enrolled in one of the following Class(es): Senior
Pre-Requisite(s): EH 4400 and EH 4090 and EH 3100

EH 4900 - Internship in Exercise Science
Practical and didactic training in Exercise Science in an approved internship site. Provides practical experience in one or more work settings, assisting the senior student in making an appropriate career choice. Students work 100 hours, plus write a paper and make a presentation to the class.
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
Pre-Requisite(s): EH 4400 and EH 4090 and EH 3100

EH 4950 - Special Topics in Physical Activity
Only open to Health and Physical Education majors. Departmental approval necessary.
Credits: 1.0; Repeatable to a Max of 5
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of department required

EH 4990 - Special Topics in Exercise Science
Examination of current topics in the field of exercise science. Literature and research topics are addressed.
Credits: variable to 6.0; Repeatable to a Max of 6
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of instructor required; May not be enrolled in one of the following Class(es): Freshman, Sophomore

Engineering Fundamentals
ENG 1001 - Engineering Problem Solving
Introduction to the engineering problem solving method and to modern tools used to solve problems.
Credits: 2.0
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Fall
Pre-Requisite(s): MA 1031(C) or MA 1032(C)

ENG 1002 - Introduction to 3-D Spatial Visualization
Intended for first-year engineering students with a demonstrated need for the development of 3-D spatial visualization skills. Topics include isometric sketching, orthographic projection, object transformations, 3-D coordinate systems, patterns folding to 3-D objects, and cross sections of solids.
Credits: 1.0
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall

ENG 1003 - Introduction to Computer Aided Drafting
Fundamentals of creating engineering drawings with modern CAD software. Topics include basic geometric construction, drawing modification, dimensioning, and working with layers.
Credits: 1.0
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Spring
Pre-Requisite(s): ENG 1101 or ENG 1002 or ENG 1100

ENG 1100 - Engineering Analysis
An introduction to the engineering profession. Focuses on engineering analysis, computational skills, and communication skills.
Credits: 2.0
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Spring
Pre-Requisite(s): ENG 1001 and (MA 1160(C) or MA 1161(C) or MA 1140(C))

ENG 1101 - Engineering Analysis and Problem Solving
An introduction to the engineering profession and to its various disciplines. Focuses on developing problem-solving skills, computational skills, and communication skills. Through active, collaborative work, students work on teams to apply the engineering problem-solving method to "real-world" problems.
Credits: 3.0
Lec-Rec-Lab: (0-0-5)
Semesters Offered: Fall, Spring, Summer
Pre-Requisite(s): MA 1160(C) or MA 1161(C) or MA 1140(C)

ENG 1102 - Engineering Modeling and Design
Continuation of ENG1101. Introduction to the engineering design process with an emphasis on graphics and documentation. Focuses on engineering problem solving in the context of the design process.
Credits: 3.0
Lec-Rec-Lab: (0-0-5)
Semesters Offered: Fall, Spring, Summer
Pre-Requisite(s): ENG 1101 or (ENG 1001 and ENG 1100) and (MA 2160(C) or MA 2140(C))

ENG 1990 - Special Topics in Engineering
Engineering topics of interest to students and faculty that are not normally covered in the existing courses.
Credits: variable to 5.0; Repeatable to a Max of 6
Semesters Offered: On Demand

ENG 2110 - Statics
Force systems in two or three dimensions. Includes composition and resolution of forces and force systems, principles of equilibrium applied to various bodies, simple structures, friction, centripetal, and moments of inertia. Vector algebra used where appropriate.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring
Pre-Requisite(s): MA 2160

ENG 2120 - Statics-Strength of Materials
The composition and resolution of forces and force systems, principles of equilibrium applied to various bodies, simple structures, friction, and 2nd moments of area. Intro to the mechanical behavior of materials, including calculation of stresses, strains, and deformations due to axial, torsional, and flexural loading.
Credits: 4.0
Lec-Rec-Lab: (0-4-0)
Semesters Offered: Fall, Spring
Restrictions: May not be enrolled in one of the following Major(s): Civil Engineering, Mechanical Engineering
Pre-Requisite(s): MA 2160 and PH 2100

ENG 2150 - Mechanics of Materials
Introduction to mechanical behavior of materials, including stress/strain at a point, principle stresses and strains, stress-strain relationships, determination of stresses and deformations in situations involving axial loading, torsional loading of circular cross sections, and flexural loading of straight members. Also covers stresses due to combined loading and buckling of columns.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring
Pre-Requisite(s): ENG 2110 or MEEM 2110

ENG 2990 - Special Topics in Engineering
Engineering topics of interest to students and faculty that are not normally covered in the existing courses.
Credits: variable to 5.0; Repeatable to a Max of 6
Semesters Offered: On Demand

ENG 3000 - Engineering for Non-Believers
Everything you wanted to know about engineering but were afraid to ask. This course will take students on a journey through time investigating engineering's greatest feats and greatest lies. Students will work in teams to uncover basic engineering principles and how basic math skills help engineers do the things they do.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following College(s): College of Engineering
Pre-Requisite(s): UN 2002(C)

ENG 3200 - Thermodynamics/Fluid Mechanics
Provides engineering students with a unified understanding of the fundamental conservation laws and property accounting applied to thermodynamic and fluid dynamic systems. Topics will include but are not limited to: ideal gas behavior; heat, work, and energy; 1st and 2nd laws of thermodynamics; heat pumps; cycles; hydrostatics; Bernoulli; pipe flow and loss; and lift and drag.
Credits: 4.0
Lec-Rec-Lab: (0-4-0)
Semesters Offered: Fall, Spring
Pre-Requisite(s): MA 2160 and (CH 1110 or CH 1110) and PH 2100
ENG 3507 - Introduction to Fluid Mechanics
Provides engineering students with a unified understanding of fluid dynamic systems. Topics will include but are not limited to hydrostatics, Bernoulli, pipe flow and loss, and lift and drag. Course offered second half of spring semester.
Credits: 2.0
Lec-Rec-Lab: (0-2-0)
Semesters Offered: Spring
Pre-Requisite(s): PH 2100 and (CH 1100 or CH 1110) and MA 2160

ENG 3530 - Undergraduate Colloquium in Sustainability
Readings and speakers are used to teach concepts of sustainable development and global sustainability. Specific topics are derived from the industrialized and developing world.
Credits: 1.0
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Graduate

ENG 5990 - 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

ENG 4160 - Teaching Methods in Technology and Design
Course intended for students pursuing technology and design secondary teacher certification. Students enroll in this course during the semester of their directed teaching.
Credits: 1.0
Lec-Rec-Lab: (0-0-3)
Semesters Offered: On Demand
Co-Requisite(s): ED 4710

ENG 4510 - Sustainable Futures I
Covers introductory and intermediate concepts of Sustainable Development. Explores methods/tools for assessing sustainability (economic, environmental, societal impacts) of current and emerging industrial technologies. Explores relationships between government policies and markets for introducing sustainable technologies into national economies and corporations.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): UN 2002

ENG 4900 - Multidisciplinary Senior Design Project I
Introduction to engineering design, including modeling, simulation, economic decision making, and reliability. Integration of design principles in the solution of open-ended engineering problems. Projects are defined and planned with faculty and industrial guidance. Emphasizes economics and environmental constraints. Students must be Senior Project ready as defined by major.
Credits: 3.0
Lec-Rec-Lab: (0-1-6)
Semesters Offered: Fall, Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior

ENG 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 1950 - Enterprise Orientation
An orientation for students to the Enterprise program. Students will evaluate and participate with several different enterprise teams as a way to familiarize themselves with the program, teams, and students through hands-on project activities.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-5)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Junior, Senior

ENT 1960 - Enterprise Orientation-Spring
An orientation for students to their specific enterprise. Covers enterprise specific topics but should also include organizational structure; past, present and future projects and their results; an evaluation of learning and personality preferences; and exploring the MTU challenge course.
Credits: 1.0
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Fall, Spring

ENT 2950 - Enterprise Project Work I
An introduction for students to their specific enterprise. Covers enterprise specific topics but should include organizational structure; past, present, and future projects and their results; an evaluation of learning and personality preferences; and exploring the MTU challenge course.
Credits: 1.0
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Fall, Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman

ENT 2960 - Enterprise Project Work II
Interdisciplinary teams work as part of an engineering enterprise to address real-world engineering design projects or problems. Second- year students are responsible for achieving some prescribed objectives and performing critical analysis of data.
Credits: 1.0
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Fall, Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman

ENT 2961 - Teaming in the Enterprise
Develops group problem-solving skills. Stresses interpersonal skills and skill assessment, communication, group process and teamwork, and action planning. Uses active, hands-on learning.
Credits: 2.0
Lec-Rec-Lab: (0-1-2)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): UN 2002(C)

ENT 2962 - Communication Contexts
An introduction to the demands of technical and professional communication in workplace settings, through analyzing project design team experiences.
Credits: 1.0
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): UN 1002 or UN 1003

ENT 2964 - Machine Tool Fundamentals and Applications
Basic machine processes including setup and operation of lathes, milling machines, drill presses, grinder and saws. Students are exposed to fundamental machining processes, nomenclature, and machine operation with an overall focus on quality control and safety.
Credits: 1.0
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall

ENT 3950 - Enterprise Project Work III
Interdisciplinary teams work as part of an engineering enterprise to address real-world engineering design projects or problems. Third-year students will practice designing approaches to solve problems and develop procedures to achieve specified project objectives.
Credits: 1.0
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Fall, Spring
Restrictions: Must be enrolled in one of the following Class(es): Junior
ENT 3954 - Enterprise Market Principles
Fundamental principles of marketing in a lecture format augmented by a simulation played in small groups. The course is completed in two day-long, Saturday sessions separated by one week. Examines marketing in the six stages of product life cycle (opportunity identification, product development, introduction, growth, maturity, and decline).
Credits: 1.0
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Fall
Restrictions: Permission of instructor required; Must be enrolled in one of the following Class(es): Junior, Senior

ENT 3956 - Industrial Health and Safety
Instruction of health and safety in engineering practice. Integrates the study of health and safety regulations, risks, and potential for improvement. Also covers the tremendous financial, ethical, and public relations implications of disregarding this critical aspect of engineering.
Credits: 1.0
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior

ENT 3957 - Product/Process Development I
Course provides an overview of the major activities involved in developing a product or service which will satisfy the customer. Introduces major engineering tools used for team-based integrated product/process development (IPPD) such as project management, benchmarking, quality function deployment, process flow charting, cost analysis, and failure modes and effects analysis.
Credits: 1.0
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Major(s): Biomedical Engineering, Engineering, Civil Engineering, Chemical Engineering, Computer Engineering, Electrical Engineering, Environmental Engineering, Geological Engineering, Mechanical Engineering, Materials Science and Engrg; May not be enrolled in one of the following Class(es): Freshman

ENT 3958 - Ethics in Engineering Design and Implementation
The focus of this course is on ethical considerations in the engineering design and implementation process. Basic ethical analysis tools will be explored through various exercises. Students will analyze and present life engineering ethics case studies.
Credits: 1.0
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Fall, Spring
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 3960 - Enterprise Project Work IV
Interdisciplinary teams work as part of an engineering enterprise to address real-world engineering design projects or problems. Third-year students practice designing approaches to solve problems and develop procedures to achieve specified project objectives.
Credits: 1.0
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Fall, Spring
Restrictions: Must be enrolled in one of the following Class(es): Junior

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, market analysis, marketing, business planning, development financing, and company formation.
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): (ENT 2961 or BA 2700) and UN 2002 and ENT 3954

ENT 3964 - Project Management
Project definition, developing a work breakdown structure, responsibility assignment and milestone development. Covers techniques for project scheduling and practical application of 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
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior

ENT 3966 - Design for Manufacturing
This course supplements courses that address "design for function." Products "designed for manufacturing" are lower cost, higher quality, and have a shorter time to market. The course describes how the capabilities and limitations of common manufacturing processes translate into qualitative design guidelines. Topics include design for casting, forging, sheet metal forming, machining, plastics and assembly.
Credits: 1.0
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): ENG 1102

ENT 3967 - Product/Process Development II
This course provides an overview of the major activities involved in developing a product or service which will satisfy the customer. The course introduces tools used for team-based integrated product/process development (IPPD) and cost-effective development of manufacturing processes including lean manufacturing and six sigma principles.
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 engineering enterprise.
Credits: 1.0; May be repeated
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Fall, Spring
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior

ENT 3971 - Seven Habits of Highly Effective People
Focuses on personal and professional effectiveness through greater productivity, increased influence in key relationships, stronger team unity and complete life balance. This course will explore these areas through interactive exercises, case studies, videos, and sharing of experiences.
Credits: 1.0
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior

ENT 3972 - Practical Electronic Circuit Design and Fabrication
This is a hands-on laboratory course that focuses on practical implementation of electronic circuits, especially for students enrolled in the Enterprise Program. Topics include grounding, wiring, analog/digital circuits, power supplies, EMC, board layout/fab/test, soldering, safety and instrumentation.
Credits: 1.0
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring
Restrictions: Permission of instructor required

ENT 3973 - Introduction to Geohydrological Characterization Techniques
Students will have the opportunity to conduct geohydrologic field work and apply the principles observed in the field to mathematical models. They will learn basic hydrologic-oriented analytical techniques for evaluating well water. The course will require a weekend field excursion.
Credits: 1.0
Lec-Rec-Lab: (0-0-1)
Semesters Offered: Fall, Spring

ENT 3974 - Fuel Cell Fundamentals
This course provides an introduction to fuel cells and fuel cell systems. Topics include an overview of fuel cell construction, fuel cell chemistry, fuel cell losses and efficiency, and integrating fuel cells onto vehicles.
Credits: 1.0
Lec-Rec-Lab: (1-0-0)
Semesters Offered: Fall - Offered alternate years beginning with the 2007-2008 academic year
Pre-Requisite(s): CH 1100 or CH 1110
ENT 3975 - Introduction to Vehicle Design and System Modeling
Enterprise module introduces students to vehicle design process and system modeling. Students will be shown the formulation of math based models of systems and will use MATLAB as the computing engine. Computing applications include matrixes, arrays, logical operators, program control flow, looping, iterative solutions and output manipulation including two and three dimensional graphics. The course is presented in an interactive Lecture/Computer Laboratory format. Theory is developed for each topic, demonstrated in MATLAB and example problems are solved by students using MATLAB during the period.
Credits: 1.0
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Fall
Pre-Requisite(s): ENG 1102

ENT 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 4950 - Enterprise Project Work V
Interdisciplinary teams work as part of an engineering enterprise to address real-world engineering design projects or problems. Fourth-year students gain experience in defining project objectives, planning strategies to achieve these objectives, and leading technical teams to accomplish project goals. Must be Senior Project ready as defined by major.
Credits: 2.0
Lec-Rec-Lab: (0-0-6)
Semesters Offered: Fall, Spring
Restrictions: Must be enrolled in one of the following Class(es): Senior

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 4952 - Complex Communication Practices
Students apply strategies and knowledge learned in ENG2962 and ENG3962 to the achievement of more complex communication practices demanded in technical and professional settings. Emphasizes creating professional identities, management communication skills, and responsible messages within teams and organizations and for a variety of technical and nontechnical audiences.
Credits: 1.0
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Fall, Summer
Pre-Requisite(s): ENT 3962 and (UN 1002 or UN 1003)

ENT 4954 - Global Competition
Emphasizes unique economic, market, and political risks faced by organizations as operations expand beyond domestic borders. Discusses establishing risk profiles to analyze new labor, product, capital markets on a global scale and appropriate market entry strategies. Small teams will do a risk profile and recommend market entry strategies for selected countries.
Credits: 1.0
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Fall
Pre-Requisite(s): ENT 4961 and UN 2002

ENT 4960 - Enterprise Project Work VI
Interdisciplinary teams work as part of an engineering enterprise to address real-world engineering design projects or problems. Fourth-year students gain experience defining project objectives, planning strategies to achieve these objectives, and leading technical teams to accomplish project goals.
Credits: 2.0
Lec-Rec-Lab: (0-0-6)
Semesters Offered: Fall, Spring
Restrictions: Must be enrolled in one of the following Class(es): Senior

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

English as a Second Language

ESL 0100 - Special Topics
For students of English as a second language; not for native speakers of English. Course is used to offer special topics in English or skills in the English language for which a demand develops.
Credits: variable to 4.0; Graded Pass/Fail Only
Semesters Offered: On Demand

ESL 0210 - Beginning Reading/Vocabulary
For students of English as a second language; not for native speakers of English. Emphasis is on vocabulary acquisition, word form, and morpheme recognition; comprehension of main ideas, structural details, and summary; critical-thinking skills.
Credits: 4.0; May be repeated; Graded Pass/Fail Only
Lec-Rec-Lab: (0-3-3)
Semesters Offered: Fall, Spring

ESL 0220 - Beginning Writing/Grammar
For students of English as a second language; not for native speakers of English. Emphasis is on understanding sentence basics, paragraph structure, basic grammar. Students write sentences and paragraphs using present, past and future tense and participate in peer editing.
Credits: 4.0; Graded Pass/Fail Only
Lec-Rec-Lab: (0-3-3)
Semesters Offered: Fall, Spring, Summer

ESL 0230 - Beginning Listening/Speaking
For students of English as a second language; not for native speakers of English. Emphasis on basic pronunciation and listening comprehension in North American English; includes patterns of rhythm and intonation; and conversation practice.
Credits: 4.0; Graded Pass/Fail Only
Lec-Rec-Lab: (0-3-3)
Semesters Offered: Fall, Spring, Summer

ESL 0290 - Beginning Special Topics
For students of English as a second language; not for native speakers of English. Concentrated study of a specific area of ESL. Example: English for computer users.
Credits: variable to 6.0; Graded Pass/Fail Only
Semesters Offered: Fall, Spring, Summer

ESL 0310 - Intermediate Read/Vocabulary
For students of English as a second language, not for native speakers of English. Emphasis is on vocabulary acquisition, word form and morpheme recognition, comprehension of main ideas and structural details, critical-thinking skills and class discussion. Students learn to take notes, outline and summarize.
Credits: 4.0; May be repeated; Graded Pass/Fail Only
Lec-Rec-Lab: (0-3-3)
Semesters Offered: Fall, Spring

ESL 0320 - Intermediate Writing/Grammar
For students of English as a second language, not for native speakers of English. Emphasis is on writing essays using the process approach to writing and collaborative workshop approach to revision in writing academic essays.
Credits: 4.0; May be repeated; Graded Pass/Fail Only
Lec-Rec-Lab: (0-3-3)
Semesters Offered: Fall, Spring

ESL 0330 - Intermed. Listening/Speaking
For students of English as a second language; not for native speakers of English. Emphasis is on pronunciation and conversation, including rhythms, stress, and intonation; provides practice in social and academic English conversation using American culture as content.
Credits: 4.0; Graded Pass/Fail Only
Lec-Rec-Lab: (0-3-3)
Semesters Offered: Fall, Spring, Summer

ESL 0390 - Intermediate Special Topics
For students of English as a second language; not for native speakers of English. Concentrated study of a specific area of ESL in greater depth than in other courses. Examples: English for computer users, idioms. Contact Director of ESL Programs.
Credits: variable to 4.0; May be repeated; Graded Pass/Fail Only
Semesters Offered: On Demand
ESL 0399 - Intermediate Independent Study
For students of English as a second language, not for native speakers of English. Selected areas in ESL based on interest and need of student. Interested students should contact the Director of English as a Second Language Programs.
Credits: variable to 6.0; May be repeated; Graded Pass/Fail Only
Semesters Offered: On Demand

ESL 0410 - Advanced Reading/Vocabulary
For students of English as a second language, not for native speakers of English. Emphasis is on preparing students for academic study through the development of effective reading strategies, vocabulary acquisition, note-taking, inferring, summarizing, critical thinking and discussion, and understanding American culture.
Credits: 4.0; May be repeated; Graded Pass/Fail Only
Lec-Rec-Lab: (0-3-3)
Semesters Offered: Fall, Spring

ESL 0420 - Advanced Writing/Grammar
For students of English as a second language, not for native speakers of English. Emphasis is on the process approach to writing, collaborative workshop approach to revision, and APA style documentation in writing academic essays and research papers.
Credits: 4.0; May be repeated; Graded Pass/Fail Only
Lec-Rec-Lab: (0-3-3)
Semesters Offered: Fall, Spring

ESL 0430 - Advanced Listening/Speaking
For students of English as a second language; not for native speakers of English. Emphasis on improving pronunciation; social and academic conversation; academic presentations.
Credits: 4.0; May be repeated; Graded Pass/Fail Only
Lec-Rec-Lab: (0-3-3)
Semesters Offered: Fall, Spring, Summer

ESL 0490 - Advanced Special Topics
For students of English as a second language, not for native speakers of English. Concentrated study in a specific area of ESL in greater depth than in other courses. Examples: academic writing, business English. Contact Director of ESL Programs.
Credits: variable to 4.0; May be repeated; Graded Pass/Fail Only
Lec-Rec-Lab: (0-3-3)
Semesters Offered: On Demand

ESL 0499 - Advanced Independent Study
For students of English as a second language, not for native speakers of English. Selected areas of ESL based on student need. Interested students should contact the Director of English as a Second Language Programs.
Credits: variable to 6.0; May be repeated; Graded Pass/Fail Only
Semesters Offered: Fall, Spring

ESL 0510 - Academic Support Writing/Grammar
For students of English as a second language; not for native speakers of English. Emphasis on improving academic reading and writing skills; includes grammar, summary, paraphrase, documentation, research writing.
Credits: 3.0; May be repeated; Graded Pass/Fail Only
Lec-Rec-Lab: (0-3-3)
Semesters Offered: Fall, Spring, Summer
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior

ESL 0520 - Academic Support Listening/Speaking
For students of English as a second language; not for native speakers of English. Emphasis on improving pronunciation and conversation skills; academic discussion skills; academic presentations.
Credits: 3.0; May be repeated; Graded Pass/Fail Only
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring
Restrictions: May not be enrolled in one of the following Class(ies): Freshman, Sophomore, Junior

ESL 0590 - Academic Support Spec Topics
For students of English as a second language, not for native speakers of English. Study a specific area of ESL in greater depth than in other courses. Examples: graduate/research writing, business English, academic presentations. Contact Director of ESL Programs.
Credits: variable to 4.0; May be repeated; Graded Pass/Fail Only
Semesters Offered: On Demand
Restrictions: May not be enrolled in one of the following Class(ies): 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

Visual and Performing Arts

FA 1150 - Drawing
Introduction to and practice of fundamental principles of drawing. Develops skills in representational drawing, perspective, and composition. Introduces creative and modern drawing techniques using a wide range of subject matter. Slide lectures and discussions illustrate classic principles while encouraging development of individual expression.
Credits: 3.0
Lec-Rec-Lab: (0-1-4)
Semesters Offered: Fall, Spring

FA 1701 - Backstage Technology
Overview of the basic techniques, theories, and terminology of technical theatre. Focus on practical application of stagecraft and rigging for a theatrical production, safety in technical theatre, physical theatre structures, production processes, and theatre organization.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall

FA 1702 - Lighting and Sound Technology
Overview of the basics of theatrical lighting, stage electrics, audio systems, and techniques for theatrical production. Focus on practical application of static and automated lighting for a theatrical production, including instrumentation and control. Introduction to live sound reinforcement, recording, and complex playback.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring

FA 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 costing 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 - Offered alternate years beginning with the 2008-2009 academic year

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

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: (0-1-4)
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: (0-1-4)
Semesters Offered: Fall

FA 2300 - Two-Dimensional Design
Introduction to basic design, composition, and color theory through imagery and design in two-dimensional media. Equal emphasis placed on thought processes and manual skill. The organization of space in two dimensions is taught through a variety of methods and materials. Emphasizes creativity, inventiveness, and experimentation.
Credits: 3.0
Lec-Rec-Lab: (0-2-3)
Semesters Offered: Spring

FA 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: (0-2-3)
Semesters Offered: Fall, Spring
Undergraduate Course Descriptions, 2007-08, Page 39 of 86
FA 3300 - Three-Dimensional Design
Introduction to three-dimensional creative processes through expressive use and exploration of a wide range of materials and techniques based on current theories. Students study elements and organizing principles of art; three-dimensional drawing techniques; theories of architecture and interior design; and additive, subtractive, and experimental sculpture.
Credits: 3.0
Lec-Rec-Lab: (0-2-3)
Semesters Offered: Spring - Offered alternate years beginning with the 2005-2006 academic year
Pre-Requisite(s): UN 1002 or UN 1003

FA 3305 - Ceramics II
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: (0-2-3)
Semesters Offered: Spring - Offered alternate years beginning with the 2008-2009 academic year
Pre-Requisite(s): FA 2305

FA 3330 - Art History I
The world history of art, sculpture, and architecture. Focuses from the Paleolithic period to the Renaissance. Discusses how art relates to religion and informs a more complete view of society and technology.
Lecture/discussion/slides, group work, and presentations.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall - Offered alternate years beginning with the 2002-2003 academic year
Pre-Requisite(s): UN 1002 or UN 1003

FA 3333 - Sculpture
Theory, tools, and media of sculpture. Focuses primarily on clay, plaster, 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: (0-1-4)
Semesters Offered: Fall - Offered alternate years beginning with the 2001-2002 academic year

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: (0-2-3)
Semesters Offered: Fall, Spring
Pre-Requisite(s): FA 3333

FA 3340 - Art History II
Survey of art in the Western world from the Renaissance to the 20th century. Emphasizes the characteristics of period style and the influence of the time on the artist.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2003-2004 academic year
Pre-Requisite(s): UN 1002 or UN 1003

FA 3400 - Keweenaw Symphony Orchestra
A university/community orchestra studying and performing orchestral literature, including the classics, contemporary, choral, orchestral, and pops. The orchestra performs three to four concerts each year, often featuring professional guest artists. Audition required.
Credits: 1.0; May be repeated
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Fall, Spring

FA 3401 - Wind Symphony
The Wind Symphony is a concert wind ensemble of variable size and instrumentation for students with a serious interest in musical performance at a high level. Features a comprehensive approach to the literature to be performed, including study of composers and historical background. Audition required.
Credits: 1.0; May be repeated
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Fall, Spring

FA 3400 - 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 3510 - Concert Choir
A select ensemble made up of student and community singers studying and performing choral literature ranging from chant to avant garde compositions. Activities include campus and community performances and occasional regional and international tours. Audition required.
Credits: 1.0; May be repeated
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Fall, Spring

FA 3530 - Music Theory II
Study of fundamentals of tonal harmony, including expanded harmonies. Study of complex rhythms. Introduction to formal and harmonic analysis. Ear training and sight-reading. Utilizes synthesizers, computers, and music software.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): FA 2500 and (UN 1002 or UN 1003)

FA 3550 - History of Jazz
Covers the musical, historical, and sociological elements of America's only original musical art form, jazz. Focuses on the major stylistic eras from 1900 to the present in addition to the major artists and their contributions. Emphasizes developing interactive, aural, and critical skills.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Summer
Pre-Requisite(s): UN 1002 or UN 1003

FA 3560 - Music History
Developments in Western music from antiquity to the present. Includes a brief examination of pre-Christian, medieval, and Renaissance music. Concentrates on musical development of the baroque, classical, romantic, and twentieth-century periods. Emphasizes the relationship between music expression and society, including non-Western influences.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Pre-Requisite(s): FA 1701 and FA 1702

FA 3660 - Mainstage Theatre: Management and Design
Open to students who take significant responsibility for aspects of major Fine Arts theatre production, such as stage manager, assistant designer, or assistant director.
Credits: variable to 3.0; May be repeated
Semesters Offered: Fall, Spring
Pre-Requisite(s): FA 2661

FA 3662 - Mainstage: Sound Design
Open to students who take significant responsibility for sound on major Fine Arts production, such as sound designer, recording enginee, live sound engineer.
Credits: variable to 3.0; May be repeated
Semesters Offered: Fall, Spring
Pre-Requisite(s): FA 2662

FA 3670 - Acting Ensemble
Learn improvisation by working with exercises, games, mindfulness techniques, and interpersonal interaction. Activities include performances and workshops at MTU, in K-12 schools, and as part of MTU's theatre productions. Audition required.
Credits: 1.0; May be repeated
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Fall, Spring

FA 3700 - Scenic Design
Introduction to designing theatrical scenery through various design projects. Students are involved with a Fine Arts department set design. Focus on practical design presentation techniques, specific drafting conventions for theatrical designs, designer/director relationships, script analysis and design concepts, design history, and styles of design.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2000-2001 academic year
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, Summer
Pre-Requisite(s): UN 1002 or UN 1003

FA 3731 - Audio Creative Lab I
A creative lab for students interested in the aural arts. Students will be challenged to create sound designs and compositions in response to various aesthetic, dramatic, and philosophical goals for radio, multimedia, and live performance. Credits: 1.0
Lec-Rec-Lab: (0-0-1)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): FA 1702 and FA 3730

FA 3732 - Audio Creative Lab II
A creative lab for students interested in the aural arts. Students will be challenged to create sound designs and compositions in response to various aesthetic, dramatic, and philosophical goals for radio, multimedia, and live performance. Note: FA3731 and FA3732 cover different projects and can be taken independently of one another. Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2006-2007 academic year
Pre-Requisite(s): FA 3730 and FA 1702

FA 3740 - Recording
Hands-on learning in the art of the recording engineer. Students develop an understanding of pop and classical recording approaches, skills to decide which approach is appropriate for a given task, and the technical knowledge necessary to implement the chosen approach. Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2005-2006 academic year
Pre-Requisite(s): FA 3730 and FA 1702

FA 3750 - Lighting Design
Introduction to designing theatrical lighting through various design projects. Students are involved with a Fine Arts department lighting design. Focuses on practical design presentation techniques, specific drafting conventions for theatrical designs, exploration of lighting equipment, designer/director relationships, script analysis and design concepts, and design history. Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2005-2006 academic year
Pre-Requisite(s): FA 3730 and FA 1702

FA 3760 - Costume Design
Introduction to designing theatrical costumes through various design projects. Students are involved with a Fine Arts department costume design. Focus on practical design presentation techniques, designer/director relationships, script analysis and design concepts, specific rendering techniques, draping and fitting. Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall - Offered alternate years beginning with the 2003-2004 academic year

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 FA 2821 and (UN 1002 or UN 1003)

FA 3810 - Ancient Theatre History
An in-depth examination of theatre history from ancient Egypt through the eighteenth century. Studies how the interrelationships among technologies, ideologies, geography, history, architecture, politics, and social expectations affected theatre productions. Students will engage in group investigative research and reporting as well as individual study. Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2005-2006 academic year
Pre-Requisite(s): UN 1002 or UN 1003

FA 3821 - Modern Theatre History
Examination of American and European theatre history from the 1700s to modern times. An emphasis on the interrelationships among technology and theatre space, design and drama, and how culture and society affected style. Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2006-2007 academic year
Pre-Requisite(s): UN 1002 or UN 1003

FA 3830 - American Musical Theatre
A multimedia examination of the development of American musical theatre from the late 1800s to the present, showing how this native theatrical form grew and how it mirrored the society of its time. Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Summer
Pre-Requisite(s): UN 1002 or UN 1003

FA 3880 - Readings in Dramatic Literature
An examination of dramatic literature with an emphasis on theatre production. Students will examine ten plays per 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: (0-1-0)
Semesters Offered: Fall, Spring
Restrictions: Must be enrolled in one of the following Major(s): Audio Production & Technology, Theatre & Entertain Tech (BS), Sound Design, Theatre & Entertain Tech (BA); May not be enrolled in one of the following Class(es): Freshman

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 1150 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: Fall - Offered alternate years beginning with the 2005-2006 academic year
Restrictions: Permission of instructor required
Pre-Requisite(s): FA 3333

FA 4400 - Chamber Music Seminar
For students interested in the study and performance of instrumental chamber music. Small ensembles meet once each week for coaching, presentations, and discussion on literature and techniques of rehearsal and performance. Credits: 1.0; Repeatable to a Max of 6
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Fall, Spring
Restrictions: Permission of instructor required

FA 4420 - Music Performance: Jazz
Jazz combos (e.g., Jaztec, Salsa Norte) are select small groups of musicians studying jazz improvisation and performing literature for the small jazz ensemble. Focuses on developing individual improvisational techniques, personal style, and unique original arrangements. Repertoire includes swing, jazz-rock, ballads, fusion, and experimental techniques. Activities can include performances and tours. Credits: variable to 6.0; Repeatable to a Max of 6
Semesters Offered: Fall - Offered alternate years beginning with the 2005-2006 academic year
Restrictions: Permission of instructor required

FA 4510 - Special Topics - Advanced Sound Studio
Introduction to professional sound work. Students produce a professional product in studio or live sound. Emphasis is placed on solid engineering practice and documentation to produce a desired artistic goal developed with the artistic performers, producers, or users. Credits: variable to 6.0; Repeatable to a Max of 12
Semesters Offered: On Demand
Restrictions: Permission of instructor required
Pre-Requisite(s): FA 3730 and FA 1702
FA 4730 - Advanced Sound Design
A study of the musicality of noise and texts and their integration in theatrical sound design, mixing, and mastering. Emphasis is on student creativity and critical listening. Develops further applications of artistic concepts introduced in FA 3730.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall - Offered alternate years beginning with the 2006-2007 academic year
Pre-Requisite(s): FA 3730 and FA 1702

FA 4740 - Transducer Theory
In depth study of Microphone and Loudspeaker design as it applies to usage in recording and live sound reinforcement with an emphasis on interaction with the acoustical environmental.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall - Offered alternate years beginning with the 2005-2006 academic year
Pre-Requisite(s): FA 3730 and FA 1702

FA 4755 - Lighting for Business and Industry
Studies of lighting uses and methods in various environments: museums, architecture, industry, automobiles, and display and event lighting. Explores types of lighting equipment control systems, design techniques, safety, reflectance and/or absorbency of surfaces, color requirements, effects on target audiences.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall - Offered alternate years beginning with the 2008-2009 academic year
Pre-Requisite(s): FA 3750

FA 4800 - Jazz Improvisation
Explores the elements of jazz improvisation while developing creative ideas and technical facility in the individual musician. Emphasis will be placed on learning the idiomatic use of the major scale and associated modes, the jazz melodic minor scale, the blues scale, pentatonic scales, and the 8-tone dominant scale. Development of stylistic conformity by exploring the styles of swing, bebop, cool, blues, Latin and rock/funk. Emphasis on the II-V-I progression in major and minor keys and symmetric harmony.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: 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: Research
Independent research directed by fine arts faculty. Projects focus on one or more of the fine arts genres (theatre, music, visual arts). Requires a written proposal setting out goals, plans for final project (e.g., research paper, research Web site), and the resources required to complete the project.
Credits: variable to 6.0; Repeatable to a Max of 6
Semesters Offered: Fall, Spring
Restrictions: Permission of instructor required

FA 4910 - Independent Study: Studio
Guided independent study directed by fine arts faculty member(s) involving creating and performing new work in the areas of music, theatre, and visual arts. Requires a written proposal setting out goals, plans for final project, and the resources required to complete the project.
Credits: variable to 6.0; Repeatable to a Max of 6
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of instructor required

FA 4915 - Independent Study with CAML Access
Allows students to use the Fine Arts (CAML) Computer Lab while engaged in an independent study project supervised by a Fine Arts Department faculty member.
Credits: variable to 3.0; May be repeated
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of instructor required

FA 4950 - Special Topics in Fine Arts
Tutorial, seminar, or class study of a topic of special interest and importance in fine arts.
Credits: variable to 6.0; Repeatable to a Max of 6
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of instructor required

FA 4960 - Special Topics Workshop
Special workshop projects in the fine arts.
Credits: variable to 6.0; Repeatable to a Max of 6
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of instructor required

FA 4970 - Fine Arts Final Project
Capstone course extending the student's knowledge and skill in a chosen fine arts discipline through independent research or other focused creative activity. A detailed proposal of the student's final project must be approved in writing by a Fine Arts faculty advisor before the student enrols in FA4970.
Credits: variable to 3.0
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of instructor required

FA 4971 - Fine Arts Final Project with Computer Lab Access
Capstone course extending the student's knowledge and skill in a chosen fine arts discipline through independent research or other focused creative activity utilizing the Fine Arts Computer Lab. A detailed proposal of the student's final project must be approved in writing by a Fine Arts faculty advisor before student enrols in FA4971.
Credits: variable to 3.0; May be repeated
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of instructor required

FA 4972 - Fine Arts Final Project with Sound Studio Access
Capstone course extending the student's knowledge and skill in a chosen fine arts discipline through independent research or other focused creative activity utilizing the Fine Arts Sound Studio. A detailed proposal of the student's final project must be approved in writing by a Fine Arts faculty advisor before the student enrols in FA4972.
Credits: variable to 3.0; 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

FA 4973 - Portfolio Presentation
A public presentation of an array of art work completed by a student as part of the minor in Art or a Fine 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
Restrictions: Permission of instructor required

Forest Resources & Environmental 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 2010 - Vegetation of North America
Identification of trees and shrubs. Study of seed dispersal, dormancy, seedbed requirements, shade tolerance, life span, and ecology, with an emphasis on trees. Systematic study of the major forested vegetation types of North America.
Credits: 4.0
Lec-Rec-Lab: (2-1-3)
Semesters Offered: Fall

FW 2020 - Basic Ecology Field Skills
Basic field techniques for identifying forest plant species, quantifying their size and abundance, summarizing field data, and presenting results.
Credits: 1.0
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall
Restrictions: Permission of department required

FW 2050 - Measuring Forest Resources
Introduction to the techniques used to measure and evaluate forest ecosystems. Includes land measurement, field use of maps and air photos, vegetation measurement, species classification, estimation of tree volumes and biomass, sampling designs, basic descriptive statistics, and the use of computers for summarizing and presenting data.
Credits: 3.0
Lec-Rec-Lab: (2-0-3)
Semesters Offered: Fall
FW 2051 - Field Techniques
Equipment and techniques used to measure forest ecosystem attributes and
perform fieldwork. Topics include field safety, land measurement and
navigation, establishment of sample locations, measurement of attributes of
individuals and groups of trees, vegetation and other organisms.

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

FW 3010 - Practice of Silviculture
Methods of controlling the establishment, growth, composition, health and
quality of forests and woodlands to meet the diverse needs and values of
landowners and society on a sustainable basis.

Credits: 4.0
Lec-Rec-Lab: (2-1-3)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Major(s): FW 3098 or FW 3050 or FW 3051
Pre-Requisite(s): FW 2010 and (FW 2050 or 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: 1.0
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Major(s): Forestry, App
Ecol & Environ Sci, Wildlife Ecology & Mgmt, Forestry
Pre-Requisite(s): FW 2010 and (FW 2050 or FW 2051)

FW 3020 - Forest and Landscape Ecology
Gain a basic understanding of how forest ecosystems function across various
temporal and spatial scales. Emphasizes real-world problems and the skills
necessary to resolve land-use conflicts and to manage terrestrial ecosystems.

Credits: 3.0
Lec-Rec-Lab: (2-0-3)
Semesters Offered: Fall
Pre-Requisite(s): FW 2010(C) and (FW 2050(C) or FW 2051(C))

FW 3075 - Introduction to Biotechnology
Basic concepts and practical applications of biotechnology and genetic
engineering. Topics include advances and practical applications relating to
improving quality and field performance of agricultural crops, environmental
remediation, and phyto-pharmaceutics. Recent advances in gene containment,
regulatory, societal and environmental issues associated with
commercialization of genetically modified organisms will be discussed.

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

FW 3098 - Wood Processing and Manufacture
A huge variety of products are manufactured from wood. Wood-based
manufacturing plants in the upper Midwest are visited during the week prior to
the start of the fall semester. Plant similarities and differences are discussed
during class meetings.

Credits: 2.0
Lec-Rec-Lab: (1-0-3)
Semesters Offered: Fall
Pre-Requisite(s): FW 1035

FW 3110 - Natural Resource Policy
Covers concepts related to social systems and natural resources. Offers a
survey of natural resource policies and organizations. State and federal levels
of policymaking will be linked to the human values, attitudes, and beliefs that
set the context for natural resource policy processes.

Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Pre-Requisite(s): UN 2002(C)

FW 3150 - Timber Harvesting
Methods and techniques used in timber harvesting systems. Emphasizes best
management practices, aesthetic and ecological impacts, logging cost
analysis, timber appraisal, and timber sale preparation and administration.

Credits: 2.0
Lec-Rec-Lab: (1-0-3)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Major(s): Forestry
Pre-Requisite(s): FW 2050 or FW 2051

FW 3170 - Land Measurements and GPS
Basic field measurements and computations involved in determining direction,
distance, and area. Covers the hand compass, pacing, and use of global
positioning systems, including differential correction. Explores use of GIS in
map generation.

Credits: 1.0
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Major(s): Wildlife
Ecology & Mgmt, App Ecol & Environ Sci, Forestry
Co-Requisite(s): FW 3190
Pre-Requisite(s): FW 3540

FW 3180 - Geomorphology, Landscapes and Ecosystems
Provides basic understanding of the geologic and glacial processes that
shaped the landscape of the Upper Midwest influencing the distribution and
productivity of modern-day plant communities. Topics include geology of
Michigan, glacial geomorphology, soil development, landscape and community
ecology, and forestry.

Credits: 2.0
Lec-Rec-Lab: (1-0-3)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Major(s): Wildlife
Ecology & Mgmt, App Ecol & Environ Sci; May not be enrolled in one of the
following Class(es): Freshman

FW 3190 - Multi-resource Assessment
Develops a basic proficiency in the application of multiple-resource
measurement techniques. Gain familiarity with the application of individual tree
and landscape measurements as well as estimation of growth, sampling
techniques, computational processes, and mapping procedures commonly
used in forest and land management.

Credits: 3.0
Lec-Rec-Lab: (0-1-4)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Major(s): Wildlife
Ecology & Mgmt, App Ecol & Environ Sci, Forestry
Pre-Requisite(s): (FW 2050 or FW 2051) and FW 3020 and (MA 2710 or MA 2710 or MA 3710)

FW 3200 - Inventory, Monitoring and Data Analysis
Sampling design, implementation and analysis for inventory and monitoring of
attributes of stands, forests and landscapes. Includes computing skills for data
date entry, storage and analysis and application of statistical techniques to answer
questions about ecological data.

Credits: 4.0
Lec-Rec-Lab: (3-0-3)
Semesters Offered: Spring
Pre-Requisite(s): (FW 2050 or FW 2051) and (MA 2710 or MA 2720 or MA 3710)

FW 3300 - Introduction to Genomics
Introduction to Genomics. Genome organization, mapping and characterization
from humans and related organisms. Topics include hierarchical arrangement
of genes, genome mapping, molecular markers of physical genome maps,
genome sequencing, comparative genomics, analysis of important human
genes and their products, and ethical and legal aspects of genomics.

Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Pre-Requisite(s): FW 2050 or FW 2051
Co-Requisite(s): FW 3540

FW 3330 - Land Measurements and GPS
Basic field measurements and computations involved in determining direction,
distance, and area. Covers the hand compass, pacing, and use of global
positioning systems, including differential correction. Explores use of GIS in
map generation.

Credits: 1.0
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Major(s): Wildlife
Ecology & Mgmt, App Ecol & Environ Sci, Forestry
Co-Requisite(s): FW 3190
Pre-Requisite(s): FW 3540

FW 3360 - Forest & Environmental Resource Management (The FERM)
Application of forest and environmental management practices by teams of
students with the assistance of faculty, staff and representatives of state,
federal and corporate land management groups as well as non-governmental
organizations.

Credits: variable to 4.0
Semesters Offered: Fall, Spring, Summer
Pre-Requisite(s): FW 2010 and (FW 2050 or FW 2051)

FW 3376 - Forest & Environmental Resource Management (The FERM)
Application of forest and environmental management practices by teams of
students with the assistance of faculty, staff and representatives of state,
federal and corporate land management groups as well as non-governmental
organizations.

Credits: variable to 4.0
Semesters Offered: Fall, Spring, Summer
Pre-Requisite(s): FW 2010 and (FW 2050 or FW 2051)

FW 3410 - Conservation Biology
Introduction to biological, social, political, and economic facets of conservation
biology. Emphasizes evaluation of how best to maintain and restore
biodiversity through management of populations and ecosystems. Topics
include mass extinctions, global change, loss and degradation of habitat, and
over exploitation of biological resources.

Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Pre-Requisite(s): UN 2002
The fundamentals of GIS and its application to natural resource management.

Spatial data, its uses and limitations are evaluated. Students work extensively with the ArcView and the ArcMap software packages.

Credits: 4.0
Lec-Rec-Lab: (3-0-3)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Major(s): Wildlife Ecology & Mgmt, Surveying Engineering, App Ecol & Envir Sci, Forestry
Pre-Requisite(s): MA 2720(C) or MA 2710(C) or MA 3710(C)

FW 3600 - Wildlife Habitat
Understand the ecological basis for management of forest wildlife and how forest management influences wildlife populations. Laboratory introduces techniques in wildlife research and management, especially methods of habitat analysis.

Credits: 3.0
Lec-Rec-Lab: (2-0-3)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Major(s): App Ecol & Envir Sci, Wildlife Ecology & Mgmt, Forestry; May not be enrolled in one of the following Class(es): Freshman

FW 3610 - Ornithology
An ecological and evolutionary approach to the study of birds. Topics include behavioral, anatomical, and physiological adaptations to flight, life history, mating systems, migration, communication and conservation. Laboratory emphasizes identification and experimental use of birds as model organisms.

Credits: 4.0
Lec-Rec-Lab: (3-0-3)
Semesters Offered: Spring
Pre-Requisite(s): BL 1040

FW 3620 - Field Ornithology
An introduction to field techniques and identification. Weekend trip to Whitefish Point Bird Observatory during spring migration and field note taking.

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

FW 3630 - Wildlife Habitat Diseases and Parasites
The ecological management of forest wildlife and how management influences wildlife populations. Laboratory introduces techniques in wildlife research and management, including habitat analysis. Includes detection and identification of wildlife diseases and parasites, and may include field trips to area landowners.

Credits: 4.0
Lec-Rec-Lab: (2-1-3)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following College(s): Sch of Forest Res & Envir Sci; Must be enrolled in one of the following Major(s): Wildlife Ecology & Mgmt, App Ecol & Envir Sci; May not be enrolled in one of the following Class(es): Freshman

FW 3760 - Human Dimensions of Natural Resources
Uses sociological concepts to cover facets of human relationships to natural resources, including human values, beliefs, and attitudes regarding the environment; rural resource-dependent communities; natural resource professions and expert knowledge; and the history of American perspectives on the environment.

Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Pre-Requisite(s): UN 2002

FW 3800 - Insect Ecology
Insects are widespread and diverse components of terrestrial and aquatic ecosystems. This course will consider aspects of insect ecology, including biodiversity and conservation of insects, the effects of biotic and abiotic factors on insect populations, and the trophic diversity of insects.

Credits: 2.0
Lec-Rec-Lab: (1-1-0)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Major(s): Wildlife Ecology & Mgmt, App Ecol & Envir Sci

FW 3840 - Forest Health
Drawing on examples from the Great Lakes region, and other parts of North America, this course will consider which type of insects and pathogens attack our trees and forests, how they interact with each other, and what tools we can use to effectively reduce their negative impacts of forest pests.

Credits: 3.0
Lec-Rec-Lab: (1-1-3)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Major(s): Wildlife Ecology & Mgmt, App Ecol & Envir Sci, Forestry
Pre-Requisite(s): FW 3620

FW 4080 - Forest Economics and Finance
Financial analysis and economic theory applied to forestry project analysis and selection, focusing on prices. Covers risk, regional economics, taxation, auctions, and non-market valuation. Use operations research and statistical methods to solve problems.

Credits: 3.0
Lec-Rec-Lab: (2-0-2)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior

FW 4087 - Molecular Genetics of Trees
Covers tree genome organization, structure, and function relationship of genes from trees; genome mapping using various techniques, such as RFLP, RAPD, AFLP and ESTs; GeneChip and Microarray applications; and DNA finger printing. Learn marker-assisted selection and gene tagging for qualitative and quantitative traits as well as physical mapping and map-based cloning of important genes.

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

FW 4089 - Bioinformatics
Computer applications in molecular biology. Hands-on experience with popular computer programs for DNA, RNA, and protein sequence analysis. Learn database management, data editing, assembly, and organization. Covers multiple-sequence comparisons, protein structural analysis, evolutionary relationships of genes, and use of internet for data retrieval, comparison, and analysis.

Credits: 3.0
Lec-Rec-Lab: (2-0-2)
Semesters Offered: Spring - Offered alternate years beginning with the 2005-2006 academic year
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore

FW 4110 - Tree Seeding Production and Greenhouse Management
Demonstrates greenhouse culture of trees from seed or vegetative cuttings. Topics include production of containerized seedlings; vegetative propagation via budding, grafting, and rooting of cuttings; and genetic manipulation. Students have hands-on roles in the routine greenhouse culture, such as media preparation, pest management, and fertilization.

Credits: variable to 4.0
Semesters Offered: Spring

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

FW 4120 - Tree Physiology and Genetics
Introduction to the genetics and physiology of forest trees. Develops a basic understanding of how trees grow and develop and why they vary from tree to tree. Covers modern methods to improve forest trees.

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

FW 4130 - Biometrics
Application of statistical and mathematical methods to ecological issues. Subjects include exploratory data analysis, monitoring programs and development of prediction equations.

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

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): MA 2720 or MA 2710 or MA 3710

FW 4150 - Forest Resource Management
Methods of organizing forest properties for sustainability and multiple-use management using operations research methods, particularly linear programming, for selecting preferred options. Emphasizes developing an understanding of the strengths and weaknesses of the models used. Discusses single- and multiple-use land management formulations.

Credits: 3.0
Lec-Rec-Lab: (2-0-3)
Semesters Offered: Fall
Pre-Requisite(s): FW 3010 and FW 4080
FW 4220 - Wetlands
Study of the physical, chemical, and biological characteristics of wetlands. Describes functions and values of individual wetland types. Presents management of wetlands and laws governing wetlands. Labs concentrate on field techniques used to assess specific plant, animal, soil, and hydrological characteristics of wetlands.
Credits: 4.0
Lec-Rec-Lab: (3-0-3)
Semesters Offered: Fall
Pre-Requisite(s): UN 2002

FW 4240 - Mammmalogy
Covers the classification, structure, and natural history of mammals, including physiological, behavioral, and ecological adaptations. Through laboratory and fieldwork, emphasizes field techniques and the distribution and identification of mammals, especially those species found in the western Great Lakes.
Credits: 4.0
Lec-Rec-Lab: (3-0-3)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): BL 1040

FW 4260 - Population Ecology
Covers the principles of population ecology. Topics include measures of populations, population dynamics, and models used to describe the theories related to population dynamics.
Credits: 3.0
Lec-Rec-Lab: (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
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 4400 - Urban Forestry
Urban forestry covers the planting and maintenance of trees in urban settings. Presents modern arboriculture and tree care methods and discusses administration of urban forests. Topics covered include pest management, pruning, planting, fertilization, inventories, tree selection, and line clearance. Labs include experience in tree climbing, pruning, and planting.
Credits: 3.0
Lec-Rec-Lab: (2-0-3)
Semesters Offered: Spring

FW 4500 - Independent Study
Guided study or research on an approved forest resource topic with a chosen faculty member.
Credits: variable to 7.0; Repeatable to a Max of 7
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of instructor required

FW 4500 - Remote Sensing of the Environment
Overview of remote sensing principles and concepts. Topics include camera and digital sensor arrays, various types of imagery, structure of digital data, spectral reflectance curves, applications/case studies and introduction to digital image processing.
Credits: 3.0
Lec-Rec-Lab: (2-1-0)
Semesters Offered: Fall - Offered alternate years beginning with the 2006-2007 academic year
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore

FW 4610 - Wildlife Ecology
Covers the ecological basis for management of wildlife, including biological and sociological factors that influence management.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): BL 3400(C) or FW 3020(C)

FW 4630 - Isle Royale Field Ecology Camp
An intensive field-based course in research methods. Introduces the process of ecological science, from initial questions to devising methods to collect data to assessing the strength of conclusions drawn from the results. Course takes place at off campus field sites.
Credits: 6.0
Lec-Rec-Lab: (0-3-9)
Semesters Offered: On Demand
Restrictions: Permission of department required; May not be enrolled in one of the following Class(es): Freshman

FW 4632 - Southwest Field Ecology Camp
An intensive field-based course in research methods. Introduces the process of ecological science from initial questions to data collection to assessing results. Trip to off-campus field sites. Course begins weekends in November and ends in January.
Credits: 6.0
Lec-Rec-Lab: (0-3-9)
Semesters Offered: On Demand
Restrictions: Permission of department required; May not be enrolled in one of the following Class(es): Freshman

FW 4634 - Conservation Issues in Yellowstone
Yellowstone has a rich, complex history of conservation challenges. This course will provide in-depth explorations of conservation controversies occurring in Yellowstone; first in a MTU classroom, followed by a week-long visit to the park. Course takes place mid-July through mid-August.
Credits: 6.0
Lec-Rec-Lab: (2-0-2)
Semesters Offered: Summer
Restrictions: Permission of department required

FW 4638 - Wolf Ecology and Management
Covers wolf ecology, current status and management of wolf populations throughout the U.S., wolf prey dynamics, and field techniques utilized in the study of wild wolves. Course begins in the classroom, followed by a 4-day field trip (camping), which includes observation of captive wolves at the International Wolf Center, experience locating wild wolves (radio telemetry, howling surveys, wolf sign in the field) and a visit with wolf researchers.
Credits: 3.0
Lec-Rec-Lab: (2-0-2)
Semesters Offered: Summer

FW 4750 - Forest Diseases and Fungal Ecology
This course provides an understanding of fungi as essential components of forest ecosystems by examining both their disease-causing and beneficial roles. Students will develop the principles of fungus identification and diagnosis of diseases of trees caused by fungi and other organisms by using the specimens in the field and lab.
Credits: 3.0
Lec-Rec-Lab: (2-0-3)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): FW 3020

FW 4810 - Integrated Resource Assessment
Provides a capstone experience by integrating techniques from many of the applied ecology and forestry core courses. Covers multi-resource inventory of forested landscapes; description and evaluation of the potential for providing various natural resource outputs; development of GIS information and applications, maps, and other descriptors useful in the analysis of diverse management alternatives.
Credits: 4.0
Lec-Rec-Lab: (0-3-3)
Semesters Offered: Fall
Pre-Requisite(s): FW 3540 and FW 3020 and (FW 3190 or FW 3410)

FW 4850 - Environmental Education Methods
This course will prepare students to design and conduct environmental education programs for adults and youth in classrooms, parks, museums, nature centers, and through statewide outreach programs using a variety of teaching methods, hands-on activities, and scientific investigations.
Credits: 4.0
Lec-Rec-Lab: (2-1-1)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Undergraduate Course Descriptions, 2007-08, Page 46 of 86
GE 3410 - Mine Safety & Health Cert
Principles of health and safety in mine practice, hazard recognition, and preventive and corrective actions.
Credits: 1.0
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Summer

GE 3820 - Mechanics of Rock Materials
Analysis of stress and strain in rock for scientists and engineers. Topics range from Mohr circles for stress, incremental strain and finite strain through stress and strain tensors, and constitutive equations, with applications in 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 2350

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, Spring

GE 3900 - Field Geophysics
Introduction to field geophysical techniques including basic land surveying. Emphasizes the recording, reduction, presentation, and interpretation of gravity, magnetic, electrical, seismic, and electromagnetic data as well as the proper use, care, and calibration of equipment used to collect the data. Requires report writing. Students must provide their own transportation.
Credits: 5.0
Lec-Rec-Lab: (0-0-15)
Semesters Offered: Summer
Restrictions: Permission of department required
Pre-Requisite(s): GE 3040

GE 3910 - Geomorphology and Glacial Geology
An introduction to geologic field mapping and site investigations. Requires geological and/or engineering report and memo writing.
Credits: 3.0
Lec-Rec-Lab: (0-0-15)
Semesters Offered: Summer
Restrictions: Permission of department required
Pre-Requisite(s): GE 2000 and GE 2310 and GE 2350

GE 3915 - Introduction to Field Geology
An introduction to geologic field mapping and site investigations. Requires geological and/or engineering report and memo writing.
Credits: 3.0
Lec-Rec-Lab: (0-0-9)
Semesters Offered: Summer
Restrictions: May not be enrolled in one of the following Major(s): Applied Geophysics, Geological Engineering
Pre-Requisite(s): GE 2000 and GE 2310 and GE 2350

GE 3920 - Geologic Field Excursion
A geological field excursion of one week or more to areas of outstanding interest to geologists.
Credits: variable to 6.0; Repeatable to a Max of 6
Semesters Offered: On Demand

GE 4000 - Earth Science Teaching Experience
Development of earth science teaching skills through assisting in instruction in a geology course laboratory. Students gain experience in organizing, preparing, and presenting earth science topics and answering questions.
Credits: variable to 3.0; Repeatable to a Max of 3
Semesters Offered: On Demand

GE 4050 - Advanced Structural Geology
How rocks deform on a microstructural to hand specimen scale. Topics include dislocations, work hardening and recovery processes, annealing and recrystallization, slip systems, preferred orientation mechanisms, and foliation development.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: On Demand
Pre-Requisite(s): GE 3000

GE 4100 - Geomorphology and Glacial Geology
The study of the processes, including fluvial, glacial, wind, mass movement, and wave action, shaping the earth’s surface by erosion and deposition of geologic materials. Emphasizes the role of past and present climate. Field trips are a major component.
Credits: 4.0
Lec-Rec-Lab: (3-0-3)
Semesters Offered: Fall - Offered alternate years beginning with the 2003-2004 academic year
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): GE 2000

GE 4150 - Natural Hazards
This course focuses on current mitigation agencies and warning systems, case studies of successes and failures in hazard mitigation, and technical tools for hazard study and mitigation such as satellite remote sensing and GIS.
Credits: 3.0
Lec-Rec-Lab: (2-0-3)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): (GE 2000 or GE 2100) and UN 2002

GE 4210 - Mine Environmental Engineering
Topics include environmental problems and causes, regulations and methods to prevent or solve environmental problems (including gas emissions and dust monitoring and control), processing and discharging water treatment and unit operations, solid waste utilization and landfiling, and land remediation and reclamation.
Credits: 2.0
Lec-Rec-Lab: (2-0-0)
Semesters Offered: On Demand
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): CH 1100 or (CH 1110 and CH 1111)

GE 4250 - Fundamentals of Remote Sensing
This course focuses on the basic physics behind airborne, satellite 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 2140 or MA 2160)

GE 4360 - Materials Handling
Surface and underground materials handling methods. Selection and performance analysis of materials handling equipment. Computer applications.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: On Demand
Pre-Requisite(s): PH 2100

GE 4450 - Advanced Environmental Geophysics
Covers the principles, design, and practice of geophysical site investigation utilizing electrical and electromagnetic techniques with emphasis on near surface application pertinent to the environmental consulting industry.
Credits: 3.0
Lec-Rec-Lab: (2-0-3)
Semesters Offered: Fall
Pre-Requisite(s): GE 3040

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 2200 and GE 2000

GE 4550 - Gravity and Magnetic Interpretation Methods
Interpretation of gravity and magnetic anomalies based on forward modeling techniques, including space filtering to enhance anomalies of importance. Emphasis will also be given to the design of the gravity/magnetic survey based on cost, implementation, and interpretation methods used.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2004-2005 academic year
Pre-Requisite(s): GE 3040

GE 4600 - Reflection Seismology
Principles of reflection seismic techniques, including theoretical background and application, and hands-on computer projects. Included are acquisition, data processing, and 2D/3D data interpretation. Students conduct projects using actual commercial-quality seismic data.
Credits: 3.0
Lec-Rec-Lab: (2-1-0)
Semesters Offered: Fall, 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, Spring
GE 4630 - Mineral Industry Economics
Studies the role of minerals and metals in society and the economics of their use. Applies economic principles to examine the supply, demand, markets, and foreign trade for important minerals and metals. Examines the effect of government policies on the minerals industries. Requires a technical report.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring
Pre-Requisite(s): (EC 3001 or EC 2002 or EC 2003) and UN 2002

GE 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
Restrictions: Permission of department required

GE 4750 - Subsurface Mapping of Petroleum Prospects
Extensional, wrench and compressional features that produce petroleum traps including subsurface geometrical mapping. Lab topics include fault surface mapping, fault bifurcations, intersections, and terminations; structural integration; and volumetrics of bottom water, edge water, and fault wedge reservoirs.
Credits: 3.0
Lec-Rec-Lab: (2-0-2)
Semesters Offered: Fall
Pre-Requisite(s): GE 3000

GE 4760 - Engineering Evaluation of Mineral Deposits
Design of programs to explore and evaluate various types of mineral deposits. An integrated project includes factors such as geologic characteristics, economics, regulations, and environmental impact.
Credits: 3.0
Lec-Rec-Lab: (2-0-3)
Semesters Offered: Spring
Pre-Requisite(s): GE 2310 and GE 3000

GE 4800 - Groundwater Engineering
Application of hydrogeological principles to design well-subsurface supplies, site investigations, and subsurface remediation systems.
Credits: 3.0
Lec-Rec-Lab: (0-2-3)
Semesters Offered: On Demand
Pre-Requisite(s): GE 3850

GE 4900 - Geological Engineering Design Project I
Capstone geological engineering design course focusing on a realistic, complex, open-ended geological engineering problem. Project includes technical design, economic analysis, environmental impacts, and regulations. Report writing required. (Senior project ready as defined by major substitutes for prerequisites)
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior

GE 4910 - Geology and Field Excursion to Canada
The geology of Canada is awesome and spectacular. This course prepares the students for the trip in terms of logistics and overviews of the geology of each location that will be visited. Students may retake class for different locations.
Credits: 1.0; May be repeated
Lec-Rec-Lab: (1-0-0)
Semesters Offered: Summer

GE 4915 - Field Geology Excursions in Michigan's Upper Peninsula
Three week course which provides background necessary to understand several field sites visited as part of course. Participants are encouraged to lead other groups, particularly school groups, on visits to these sites as part of their own teaching activities.
Credits: 3.0
Lec-Rec-Lab: (0-0-9)
Semesters Offered: Summer

GE 4918 - Geology and Field Excursion to Canada Preparation
The geology of Canada is awesome and spectacular. This course prepares the students for the trip in terms of logistics and overviews of the geology of each location that will be visited. Students may retake class for different locations.
Credits: 1.0; May be repeated
Lec-Rec-Lab: (1-0-0)
Semesters Offered: Spring

GE 4919 - Geology and Field Excursion to Canada
The geology of Canada is visited on this 28 day field excursion via van and camping. Canada’s geology offers spectacular study opportunities and provides a true field based experience. Students may retake class for different locations.
Credits: 3.0; Repeatable to a Max of 9
Lec-Rec-Lab: (0-0-9)
Semesters Offered: Summer
Restrictions: Permission of instructor required
Pre-Requisite(s): GE 4918

GE 4920 - Geological Engineering Seminar
Seminar course dealing with geological engineering subjects of current interest.
Credits: 3.0; Repeatable to a Max of 9
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore

GE 4921 - Geology Seminar
Seminar course dealing with geology subjects of current interest.
Credits: 3.0; Repeatable to a Max of 9
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore

GE 4922 - Geophysics Seminar
Seminar course dealing with geophysics subjects of current interest.
Credits: 3.0; Repeatable to a Max of 9
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore

GE 4928 - Special Topics in Geological Engineering
Study and discussion of geological engineering topics.
Credits: variable to 3.0; Repeatable to a Max of 9
Semesters Offered: On Demand
Restrictions: Permission of instructor required

GE 4930 - Special Topics in Mineralogy
The study of special topics in mineralogy using the Seaman Mineral Museum.
Credits: variable to 3.0; Repeatable to a Max of 6
Semesters Offered: On Demand
Restrictions: Permission of instructor required
Pre-Requisite(s): GE 2300

GE 4933 - Special Topics in Geophysics
Study and discussion of geophysics topics.
Credits: variable to 3.0; Repeatable to a Max of 9
Semesters Offered: On Demand
Restrictions: Permission of instructor required

GE 4934 - Special Topics in Mining Engineering
Study and discussion of topics in mining engineering not included in regular undergraduate courses.
Credits: variable to 3.0; Repeatable to a Max of 9
Semesters Offered: On Demand
Restrictions: Permission of instructor required

GE 4951 - Independent Geology 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 4952 - 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 4960 - Independent Geological Engineering Research Project
Approved engineering design research project originated by the student or assigned by the instructor. A final report is required.
Credits: variable to 9.0; Repeatable to a Max of 9
Semesters Offered: On Demand
Restrictions: Permission of instructor required; May not be enrolled in one of the following Class(es): Freshman, Sophomore

GE 4961 - Independent Geology Research Project
Approved literature, laboratory, and/or field geology research problem originated by the student or assigned by the instructor. A final report is required.
Credits: variable to 9.0; Repeatable to a Max of 9
Semesters Offered: On Demand
Restrictions: Permission of instructor required; May not be enrolled in one of the following Class(es): Freshman, Sophomore

GE 4962 - Independent Geophysics Research Project
Approved literature, laboratory, and/or field geophysics research problem originated by the student or assigned by the instructor. A final report is required.
Credits: variable to 9.0; Repeatable to a Max of 9
Semesters Offered: On Demand
Restrictions: Permission of instructor required; May not be enrolled in one of the following Class(es): Freshman, Sophomore
GE 4963 - Independent Mining Engineering Research Project
Approved literature, laboratory, and/or field research in mining engineering, originated by the student or assigned by the instructor. A final report is required.
Credits: variable to 9.0; Repeatable to a Max of 9
Semesters Offered: On Demand
Restrictions: Permission of instructor required; May not be enrolled in one of the following Class(es): Freshman, Sophomore

Humanities
HU 0110 - Development of Academic Literacy Skills
Scheduled weekly appointments with a writing coach to improve writing and reading effectiveness in any course except Perspectives, World Cultures, or Revisions. (For coaching in these courses, see HU0121, 0122, 0123). Specialized assistance available to students who speak English as a Second Language and students who have learning disabilities. Credits do not count toward graduation.
Credits: 0.0; May be repeated
Semesters Offered: Fall, Spring, Summer
HU 0121 - Perspectives Coaching
Scheduled weekly appointment with a writing coach to improve writing, speaking, and reading effectiveness in Perspectives (UN1001). Strongly recommended for students with English ACT of 20 or below. Credits do not count toward graduation.
Credits: 0.0; May be repeated
Semesters Offered: Fall, Spring, Summer
HU 0122 - World Cultures Study Team
Students who are enrolled in World Cultures (UN1002) may sign up for a study team led by a writing center coach. Teams meet twice weekly. The meetings address the challenges of the World Cultures course as well as develop students' effectiveness working in teams. Strongly recommended for students with English/Reading ACT of 20 or below. Credits do not count toward graduation.
Credits: 0.0; May be repeated
Semesters Offered: Fall, Spring, Summer
Co-Requisite(s): UN 1002
HU 0123 - Revisions Coaching
Scheduled weekly appointment with a writing coach to improve writing and reading effectiveness in Revisions (UN2001). Strongly recommended for students with English ACT of 20 or below. Credits do not count toward graduation.
Credits: 0.0; May be repeated
Semesters Offered: Fall, Spring, Summer
Co-Requisite(s): UN 2001
HU 0124 - Graduate Student Coaching
Scheduled weekly appointment with a writing coach to improve writing and reading effectiveness in graduate courses and to address the challenges of writing theses and dissertations. Credits do not count toward graduation.
Credits: 0.0; May be repeated
Semesters Offered: Fall, Spring, 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 HU125 to work on cultural differences in presentation skills and to practice speaking instructional English. These students will meet weekly in group and individual settings to improve their facility as speakers of English. Credits do not count toward graduation.
Credits: 0.0; May be repeated
Semesters Offered: Fall, Spring
Restrictions: Must be enrolled in one of the following Level(s): Graduate
HU 2110 - Creative Writing
Writing practice in one or more of the major creative genres, including poetry, short fiction, and literary nonfiction. Combines creative theory with process-oriented writing exercises. Stresses a workshop approach and requires a portfolio of creative work at term's end.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring, 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 2241 - Level I-A Less Commonly Taught Languages
Introduction to basic grammar, vocabulary, and idioms, designed to acquaint students with the minimum essentials of oral and written communication. Includes discussions of various aspects of the culture of the language being taught. Languages taught may include but are not limited to Ojibwe and Japanese.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring
HU 2242 - Level I-B Less Commonly Taught Languages
Further study of grammar, vocabulary, and idioms with emphasis on conversational skills. Includes continued discussion of the culture of the language being taught. Languages taught may include but are not limited to Ojibwe and Japanese.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): HU 2241
HU 2271 - Level I-A French Language and Culture
Introduction to basic French grammar, vocabulary, and idioms designed to acquaint students with the minimum essentials of oral and written French. Includes discussion of various aspects of contemporary French-speaking cultures.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring, Summer
Restrictions: May not be enrolled in one of the following Class(es): Senior
HU 2272 - Level I-B French Language and Culture
Further study of French grammar, vocabulary, idioms, continues practice of conversational skills and basic readings in French. Continues discussions of French culture are supplemented by music, films, and contact with native speakers or those with advanced French-speaking skills.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring
Pre-Requisite(s): HU 2271
HU 2273 - Transitional Level I French Language and Culture
Intensive study of French grammar, vocabulary, and culture. Designed to prepare students with minimum essentials of oral and written French for intermediate and advanced level work. Students completing this course may apply for advanced placement. Requires two years of high school French or permission of instructor.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
HU 2281 - Level I-A German Language and Culture
Introduction to basic German grammar, vocabulary, and idioms, acquainting students with the minimum essentials of oral and written German. Introduces the culture and the societies of contemporary German-speaking Europe.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring, Summer
Restrictions: May not be enrolled in one of the following Class(es): Senior
HU 2282 - Level I-B German Language and Culture
Further study of German grammar, vocabulary, and idioms, with emphasis on conversational skills. Includes continued discussion of German culture and society.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring, Summer
Pre-Requisite(s): HU 2281
HU 2291 - Level I-A Spanish Language and Culture
Introduction to basic Spanish grammar, vocabulary, and idioms, designed to acquaint students with the minimum essentials of oral and written Spanish. Includes discussion of various aspects of contemporary Spanish-speaking cultures.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, 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, continued practice of conversational skills and basic readings in Spanish. Continued discussions of Hispanic culture are supplemented by music, films, and contact with native speakers or those with advanced Spanish-speaking skills.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring
Pre-Requisite(s): HU 2291
HU 2293 - Transitional Level I Spanish Language and Culture
Intensive review of Spanish grammar, vocabulary, and culture. Designed to prepare students with minimum essentials of oral and written Spanish for intermediate and advanced level work. Students completing this course may apply for advanced placement. Requires two years of high school Spanish or permission of instructor.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring
HU 2324 - Introduction to Film
An introduction to the concepts, terminology, history, and criticism of film. Emphasizes a critical examination of film within its social, cultural, and historical contexts. Assignments may include essays, short writings, or exams in which students demonstrate their knowledge of concepts and issues introduced through readings, screenings, and discussions.
Credits: 3.0
Lec-Rec-Lab: (0-2-3)
Semesters Offered: Fall, Spring, Summer

HU 2501 - The American Experience in Literature I
A survey of writings and the oral tradition from the earliest explorers, Native Americans, and African-Americans to about 1850. Readings in such genres as histories, diaries, sermons, poetry, and short stories. Several films may be viewed.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall - Offered alternate years beginning with the 2003-2004 academic year

HU 2502 - The American Experience in Literature II
A historical survey of American Literature from about 1850 to the present, focusing on such themes as nature, the individual, democracy, race, optimism, and science. Discussions may be supplemented with films.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2003-2004 academic year

HU 2505 - Science, Technology, and Humanities I
A survey using literary texts, narrative history, documentary evidence, film, music, and cross-cultural references to contextualize the emergence of scientific, technological, and humanistic developments to the eighteenth century.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall - Offered alternate years beginning with the 2003-2004 academic year

HU 2506 - Science, Technology, and Humanities II
A survey using literary texts, narrative history, documentary evidence, film, music, and cross-cultural references to contextualize the emergence of scientific, technological, and humanistic developments in the nineteenth and twentieth centuries.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall - Offered alternate years beginning with the 2000-2001 academic year

HU 2520 - Cultural Diversity in the Literature of the Americas
Study of literature by authors of the Americas (e.g. South, Central, and North American and the Caribbean) from historically under-represented groups. Films and essays on approaches to difference and diverse American cultures may supplement literature.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring

HU 2538 - British Experience in Literature I
A survey of major works of British literature from Beowulf to the Restoration. Focuses on the states of the developing English language. Texts may be supplemented with films.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall - Offered alternate years beginning with the 2002-2003 academic year

HU 2539 - British Experience in Literature II
A survey of major works of British authors of the nineteenth and twentieth centuries. Works may be illustrated through films and other visual media.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2002-2003 academic year

HU 2547 - World Drama
Study of the forms of dramatic literature from around the world with particular attention to thematic and dramatic development. Emphasizes performance as well as literary aspects of plays. Film versions may also be viewed.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2002-2003 academic year

HU 2548 - Adolescent Literature
Reading, reflecting on, and responding to age-appropriate adolescent literature. Works include authors from different races, cultures, historical periods, and genres. Discussion may be supplemented with films. Appropriate for students who plan to be parents, community volunteers, and teachers.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Summer

HU 2600 - Introduction to Scientific and Technical Communication
An introduction to the history, theory, and practice of scientific and technical communication.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring
Restrictions: Must be enrolled in one of the following Major(s): Scientific & Tech Comm (BA), Scientific & Tech Comm (BS)

HU 2631 - Fundamentals of Photography
Students will explore the history, theory and applications of traditional black and white photography through readings, lecture, student presentations, and hands-on camera and darkroom work. Students will learn in-depth camera techniques and darkroom processes while also having an opportunity to explore related areas such as digital photography, color slide photography, and other photographic processes through special projects.
Credits: 3.0
Lec-Rec-Lab: (0-2-3)
Semesters Offered: Fall, Spring, Summer

HU 2640 - Professional Development and Technological Practicum A
Focuses on professional development by introducing students to educational and professional resources, educational and professional extracurricular activities, internships/co-ops, teaching experiences, and basic technologies of the field. Students develop templates for professional portfolios.
Credits: 1.0
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Fall

HU 2645 - Graphic and Information Design
A computer-intensive introduction to the principles for creating clear, effective graphic communication. Students critique the work of other designers in terms of the work's audience and intended effect, and they construct and critique their own design projects as well.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall

HU 2650 - Introduction to Web-Site Design
Provides experience in planning and constructing web pages. Discusses historical, ethical, and social implications of the Internet and digital culture. Students will develop a balance of technical and aesthetic knowledge and an understanding of some of the problems and limitations of the Internet and the World Wide Web.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring, Summer

HU 2700 - Introduction to Philosophy
A study of thought representing various traditions such as classical and contemporary philosophy. Eastern and Western religion, and issues in recent science. Some basic concepts of logic are also examined. Emphasizes moral philosophy, including ethical relativism, utilitarianism, and Kantian ethics.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring, Summer

HU 2701 - Logic and Critical Thinking
Introduction to everyday reasoning and formal logic. Important goal is to develop skills of argument identification, analysis, and evaluation. Students learn how to symbolize ordinary language statements and arguments and to determine their validity or invalidity using proof and truth-table methods.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall

HU 2702 - Ethical Theory and Moral Problems
An introduction to the major concepts and theories of normative ethics and metaethics and an examination of a variety of issues in applied ethics including poverty and economic justice, lying and truth-telling, euthanasia, sexual conduct, and issues in communication ethics.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Summer

HU 2820 - Communication and Culture
Introduction to the ways that communication creates and maintains culture. Considers a variety of perspectives on the significance of communication. Explores the importance of communication for understanding culture.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall

HU 2830 - Introduction to Speech Communication
Introduces the diversity of perspectives in speech communication with emphasis on public speaking. Topics include the nature of the public sphere, co-cultural contexts, speaking anxiety, conventional and non-Western models of structure and evidence, and speaking/listening competencies.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring, Summer
HU 2910 - Language and Mind  
Introduction to the linguistic study of structural and cognitive aspects of language. Topics may include examination of sounds, words, sentences, and discourse; oral, written, and electronic variation; the comparison of human ability with animals and computers; first and second language acquisition; brain architecture; the classification and distribution of world languages.  
Credits: 3.0  
Lec-Rec-Lab: (0-3-0)  
Semesters Offered: Fall, Summer

HU 2920 - Language and Society  
The study of how societies regard, use, and organize themselves with respect to language. Topics may include dialect variation based on geography, class, ethnicity, gender, etc.; language distribution and multilingualism around the world; the history and future position of English; language standards and attitudes towards minority language variants or bilingualism.  
Credits: 3.0  
Lec-Rec-Lab: (0-3-0)  
Semesters Offered: Spring

HU 3120 - Technical and Scientific Communication  
A study of written and oral communication in technical and scientific environments; emphasizes audience, writing processes, genres of scientific and technical discourse, visual communication, collaboration, professional responsibility, clear and correct expression. Students write and revise several documents and give oral report(s). 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 1002 or UN 1003

HU 3130 - Rhetorical Theory and Criticism  
A study of contemporary theories of rhetoric and their application to understanding and critiquing various forms of persuasive discourse.  
Credits: 3.0  
Lec-Rec-Lab: (0-3-0)  
Semesters Offered: Spring  
Pre-Requisite(s): UN 1002 or UN 1003

HU 3150 - Reading and Writing  
A study of how and why different groups of people use reading and writing differently in varying situations and in varying textual media. Topics may include the various ways texts function and reading is used; the authority of written texts; access to reading and writing and to various textual media.  
Credits: 3.0  
Lec-Rec-Lab: (0-3-0)  
Semesters Offered: Fall  
Pre-Requisite(s): (UN 1002 or UN 1003) and UN 2001

HU 3151 - The Rhetoric of Everyday Texts  
The examination and production of everyday texts such as image-texts, e-mail, web pages, signs, museum exhibits, architecture, and fashion in terms of their theoretical, historical, cultural, and technological contexts. Students should expect to produce “everyday texts” of their own as well as write about texts examined in the course.  
Credits: 3.0  
Lec-Rec-Lab: (0-3-0)  
Semesters Offered: Spring  
Pre-Requisite(s): UN 1002 or UN 1003

HU 3251 - Great Works of World Literature  
Study of such topics as world literature in translation, the modern novel and drama, the symbolist poets, and naturalism in modern world literature.  
Credits: 3.0; Repeatable to a Max of 6  
Lec-Rec-Lab: (0-3-0)  
Semesters Offered: On Demand  
Restrictions: May not be enrolled in one of the following Class(es): Freshman  
Pre-Requisite(s): UN 1002 or UN 1003

HU 3252 - Literature in Translation  
Study of non-canonical literature in English translation of Western and non-Western authors.  
Credits: 3.0; Repeatable to a Max of 6  
Lec-Rec-Lab: (0-3-0)  
Semesters Offered: On Demand  
Restrictions: May not be enrolled in one of the following Class(es): Freshman  
Pre-Requisite(s): UN 1002 or UN 1003

HU 3253 - Topics in World Literatures and Cultures  
Comparative approach to selected fictional works and essays in English translation of Western and non-Western authors.  
Credits: 3.0  
Lec-Rec-Lab: (0-3-0)  
Semesters Offered: On Demand  
Restrictions: May not be enrolled in one of the following Class(es): Freshman  
Pre-Requisite(s): UN 1002 or UN 1003

HU 3261 - Communicating Across Cultures  
Comparative study of interpersonal communication across cultures by both foreign and American students, with emphasis on cultural patterns, attitudes, values, and nonverbal behaviors. Instructor selects cultures for study from Third World, Western, or non-Western regions.  
Credits: 3.0  
Lec-Rec-Lab: (0-3-0)  
Semesters Offered: On Demand  
Restrictions: May not be enrolled in one of the following Class(es): Freshman  
Pre-Requisite(s): UN 1002 or UN 1003

HU 3262 - Topics in Francophone Cultures  
An introduction to Francophone cultures (in English) in a comparative perspective. Includes a survey of French history and its influence on modern-day French and Francophone societies through movies, media, and recent technologies, and a critical examination of cross-cultural differences between French and American cultures.  
Credits: 3.0  
Lec-Rec-Lab: (0-3-0)  
Semesters Offered: On Demand  
Restrictions: May not be enrolled in one of the following Class(es): Freshman  
Pre-Requisite(s): UN 1002 or UN 1003

HU 3263 - Topics in German-Speaking Cultures  
An introduction to German-speaking culture (in English) in a comparative perspective. Includes a survey of Central-European history and its influence on modern-day German-speaking societies through movies, media, and recent technologies, and a critical examination of cross-cultural differences between German and North-American cultures.  
Credits: 3.0  
Lec-Rec-Lab: (0-3-0)  
Semesters Offered: Spring  
Restrictions: May not be enrolled in one of the following Class(es): Freshman  
Pre-Requisite(s): UN 1002 or UN 1003

HU 3264 - Topics in Spanish-Speaking Cultures  
An introduction to Spanish-speaking culture (in English) in a comparative historical perspective. Includes a survey and a critical cross-cultural examination of Latin-American culture and Spanish-speaking societies (European, Caribbean, and North, Central and South American) through literature, music, film, art and other media. Spanish-speaking cultures and North American society.  
Credits: 3.0  
Lec-Rec-Lab: (0-3-0)  
Semesters Offered: Spring  
Restrictions: May not be enrolled in one of the following Class(es): Freshman  
Pre-Requisite(s): UN 1002 or UN 1003

HU 3271 - Level II-A French Language and Culture  
Review of basic grammar, introduction to advanced idiom, translation of material from French to English, and writing of compositions in French.  
Credits: 3.0  
Lec-Rec-Lab: (0-3-0)  
Semesters Offered: Fall  
Pre-Requisite(s): HU 2272 or HU 2273

HU 3272 - Level II-B French Language and Culture  
Reading of French texts and writing of compositions in French. Includes the use of oral French in the classroom.  
Credits: 3.0  
Lec-Rec-Lab: (0-3-0)  
Semesters Offered: Spring  
Pre-Requisite(s): HU 3271

HU 3273 - Level II French Composition and Conversation  
Extensive work on the creative use of written and oral French and short themes in French. Conducted as much as possible in French.  
Credits: 3.0  
Lec-Rec-Lab: (0-3-0)  
Semesters Offered: Spring  
Pre-Requisite(s): HU 2272 or HU 2273

HU 3274 - Topics in French Literature and Culture  
A survey of French literature or of various aspects of modern French civilization and culture, emphasizing historical and cultural backgrounds. Conducted primarily in French.  
Credits: 3.0  
Lec-Rec-Lab: (0-3-0)  
Semesters Offered: On Demand  
Pre-Requisite(s): HU 3272 or HU 3273

HU 3275 - French for Special Purposes  
Selected topics as posed by business, technical, scientific and/or literary disciplines in the context of French language and Francophone culture.  
Credits: 3.0; Repeatable to a Max of 6  
Lec-Rec-Lab: (0-3-0)  
Semesters Offered: On Demand  
Pre-Requisite(s): HU 3272 or HU 3273

Undergraduate Course Descriptions, 2007-08, Page 51 of 86
HU 3281 - Level II-A German Language and Culture
Review of basic German grammar. Includes study of vocabulary, idioms, and word formation to improve conversational and reading abilities, and discussion of various aspects of contemporary German culture.

Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): HU 2282

HU 3282 - Level II-B German Language and Culture
Reading of German texts and writing of compositions in German. Includes the use of oral German in the classroom.

Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): HU 3281

HU 3283 - Level II German Composition and Conversation
Extensive work on the creative use of written and oral German with emphasis on short themes in German. Conducted as much as possible in German.

Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): HU 3282 or HU 3283

HU 3284 - Topics in German Literature and Culture
A selected topic of German literature and culture considered in depth. Topics for discussion in German may include postwar German literature, the contemporary German short story, Germany since WW II, or may include emphasis on a major contemporary writer. Conducted in German.

Credits: 3.0; Repeatable to a Max of 6
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): HU 3282 or HU 3283

HU 3285 - German for Special Purposes
Introduction to selected topics in contemporary visual media. Topics may include genre studies, national cinema, independent film and video, auteur approaches, and other contemporary issues. Students are expected to examine critically the theoretical, industrial, cultural, and aesthetic challenges posed by particular visual media and the contexts from which they emerge.

Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): HU 3282 or HU 3293

HU 3291 - Level II Spanish Language and Culture
Review of Spanish grammar and intensive vocabulary development. Reading, oral and written communication at intermediate level. Includes the use of oral Spanish in the classroom.

Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): HU 2292 or HU 2293

HU 3292 - Level II-B Spanish Language and Culture
Continued development of oral and written communication in the context of Hispanic culture. Reading of Spanish texts at the intermediate level including literature, film, art, and other media. Includes the use of oral Spanish in the classroom.

Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): HU 2292 or HU 3291 or HU 3292

HU 3293 - Level II Spanish for Special Purposes
Intermediate to advanced intermediate readings, discussion, and writing on selected topics as posed by intercultural communication, business, technical, scientific, or literary discourses in the context of Hispanic culture.

Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): HU 2293 or HU 3291 or HU 3292

HU 3294 - Topics in Spanish Literature and Culture
A survey of the literature, culture, and civilization of a particular region or regions of the Spanish-speaking world. May incorporate study of literary genres and historical periods as related to Spain and/or Latin American cultures.

Credits: 3.0; Repeatable to a Max of 6
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall - Offered alternate years beginning with the 2000-2001 academic year
Pre-Requisite(s): HU 3292 or HU 3293

HU 3295 - Advanced Spanish for Special Purposes
Readings, discussion and writing on literary, scientific and technological problems and discourses (specific literacies) in Hispanic language and culture, and their social, cultural and interdisciplinary interconnections both within and outside Hispanic contexts. Emphasis is placed on the understanding of key issues across disciplines and cultures.

Credits: 3.0; Repeatable to a Max of 6
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring
Pre-Requisite(s): HU 3292 or HU 3293

HU 3324 - Visual Media Analysis
Introduction to selected topics in contemporary visual media. Topics may include genre studies, national cinema, independent film and video, auteur approaches, and other contemporary issues. Students are expected to examine critically the theoretical, industrial, cultural, and aesthetic challenges posed by particular visual media and the contexts from which they emerge.

Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): Permission of instructor required; May not be enrolled in one of the following Class(es): Freshman, Sophomore

HU 3501 - Medieval Literature
Study of such topics as King Arthur, mystery plays, the epic, and Dante's Divine Comedy as part of the literature of the Middle Ages. Films may supplement literary texts. Selected topics are offered every other year by individual instructors.

Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall - Offered alternate years beginning with the 2000-2001 academic year
Pre-Requisite(s): UN 1002 or UN 1003

HU 3502 - World Mythologies
Survey of the major mythological systems of the world with particular attention to those areas of commonality between the various civilizations. Films may provide contextual background.

Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2001-2002 academic year
Pre-Requisite(s): UN 1002 or UN 1003

HU 3504 - Novels from World Literature
Comparative approach to selected novels of Western and non-Western authors, excluding English and North American, and including works by non-European writers. Film versions of selected novels may also be studied.

Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall - Offered alternate years beginning with the 2000-2001 academic year
Pre-Requisite(s): UN 1002 or UN 1003

HU 3510 - The American Novel
Examination of the novel in America with special attention to the historical, sociological, and personal contexts within which the author is writing. Film versions of selected novels may also be studied.

Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): UN 1002 or UN 1003

HU 3512 - Shakespeare I
Study of selected plays by Shakespeare including comedies, histories, and tragedies. Film versions of several plays may also be examined.

Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): UN 1002 or UN 1003

HU 3513 - Shakespeare II
In-depth study of a limited number of Shakespearean plays with special attention to dramatic structure, character development, theme presentation, and theatre history. Includes extensive study of Renaissance influences, possibly film versions of selected plays, and examination of current critical theories.

Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): UN 1002 or UN 1003

HU 3517 - British and American Literary Studies
A consideration of a variety of critical approaches to literature and methods of Literary research in the context of Literary texts by British and American authors and possibly of film versions of the texts.

Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2004-2005 academic year

Undergraduate Course Descriptions, 2007-08, Page 52 of 86
HU 3540 - Major British Authors
Reading in depth from the works of one or more of the major British writers, excluding Shakespeare. May include examination of non-print media such as film.
Credits: 3.0; Repeatable to a Max of 6
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): UN 1002 or UN 1003

HU 3541 - Major American Authors
Reading in depth from the works of one or more major American writers. May include examination of supplementary material such as films.
Credits: 3.0; Repeatable to a Max of 6
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): UN 1002 or UN 1003

HU 3545 - Literature Across Borders
Study of literary genres, themes, and movements, with emphasis on comparing and contrasting perspectives reflected in literatures from Western and non-Western cultures. Topics may focus on historical, social, aesthetic, and cultural factors as they influence these literatures. Films may be used.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall - Offered alternate years beginning with the 2004-2005 academic year

HU 3551 - Renaissance English Literature
Study of important figures and genres in English literature from the sixteenth through the seventeenth century. Selected films may also be viewed and analyzed.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2000-2001 academic year
Pre-Requisite(s): UN 1002 or UN 1003

HU 3552 - Restoration and 18th Century English Literature
Study of important figures and genres in English literature from the late-seventeenth century through the eighteenth century. Selected films may also be viewed and analyzed.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): UN 1002 or UN 1003

HU 3553 - British Romantic and Victorian Literature
Readings of selected figures and works from nineteenth-century British literature. Genres include poetry, prose, and novels. Major topics include nature, transcendentalism, imagination, the growth of science and its impact on religious faith, and the fate of humanistic culture in a technological age. Background material may include selected films.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): UN 1002 or UN 1003

HU 3554 - British Authors of Fiction and Fantasy
Close study of the work of one or more of the major British authors of the twentieth and twentieth-first centuries with attention to the writer's style, methods, and genre usage. Will regularly focus on authors of historical fiction and fantasy. Selected films may help establish literary context.
Credits: 3.0; Repeatable to a Max of 6
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): UN 1002 or UN 1003

HU 3555 - Modern British Literature
Study of British, British colonial, and independence literature of the twentieth and twenty-first centuries. Will explore relationships between literature and other areas such as the arts, film, architecture, history, and philosophy.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2001-2002 academic year
Pre-Requisite(s): UN 1002 or UN 1003

HU 3600 - Editing
Examination of the responsibilities of an editor and grounding in basic editorial skills. Topics include situations of editing, levels of editing, readability, correctness, style, relations with authors, and social and political implications of editing.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): UN 1002 or UN 1003

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 2001 and (UN 1002 or UN 1003)

HU 3629 - Special Topics in Professional Writing
Focuses on professional and workplace writing in selected genres such as reports, proposals, or grants. Teaches students to use rhetorical analysis to be more effective writers in a range of subjects. With different topics, may be repeated twice for credit.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): UN 1002 or UN 1003

HU 3630 - Publications and Information Management
Principles of information selection, editing, layout, and graphics essential to the scheduling, budgeting, and production of various print and digital publications.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring

HU 3640 - Professional Development and Technological Practicum B
Continued professional development through exploration of job descriptions, production of internship and co-op applications, practice of interview skills, development of portfolio items, and review of professional journals and graduate school options. Students study advanced media appropriate for specific curricular strands.
Credits: 1.0
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Fall, Spring
Restrictions: Must be enrolled in one of the following Major(s): Liberal Arts, Scientific & Tech Comm (BA), Scientific & Tech Comm (BS)
Pre-Requisite(s): HU 2640

HU 3642 - Introduction to Multimedia Development
A hands-on and theoretical introduction to multimedia development. Students construct a prototype multimedia project. They plan a project; construct a project team; design an effective interface integrating color, sound, and graphics; and test. Students analyze multimedia projects and writings about multimedia.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): UN 1002 or UN 1003

HU 3700 - Philosophy of Science
Examination of problems involved in scientific methodology such as theory structure, concept formation, scientific explanation, hypothetic-deductive model, role of experimentation, function of paradigms and analogies, distinction between science and pseudoscience, extent to which science is value-free or value-laden, social responsibility of scientists, and aims of science.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): UN 2002

HU 3701 - Philosophy of Technology
A study of philosophical aspects of technology. Topics may include technology and progress; technology and ideology; technology and nature; technological determinism; ethics and technology; technology as a world view; gender, race, class, and technology; and the relationship between technology and dystopias, utopias, and the "good life."
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): UN 2002

HU 3702 - Philosophy of Religion
An examination of some philosophical questions in diverse religious traditions including the existence of God, the problem of evil, and the nature of religious experience.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): UN 1002 or UN 1003

Undergraduate Course Descriptions, 2007-08, Page 53 of 86
HU 3710 - Engineering Ethics
A study of ethical questions confronting individual engineers and the engineering profession. Among the issues to be explored are the meaning of professionalism, the social responsibilities of engineers, engineer-employer and engineer-client relationships, whistle-blowing, conflicts of interest, and competitive bidding.
Credits: 3.0  
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): UN 1002 or UN 1003

HU 3711 - Biomedical Ethics
A study of several important ethical and philosophical issues that arise in medical practice and in biomedical science. Issues may include euthanasia, abortion, the physician-patient relationship, experimentation involving human subjects, and allocation of scarce biomedical resources. General ethical theories and concepts are used to shed light on those issues.
Credits: 3.0  
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): UN 1002 or UN 1003

HU 3820 - Interpersonal Communication
Examines practices and issues of relational communication and encourages critical awareness of common assumptions. Topics include verbal and nonverbal cues, conflict models, friendship, intimacy, and the interpersonal significance of race, gender, class, and disability.
Credits: 3.0  
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): UN 1002 or UN 1003

HU 3840 - Organizational Communication
An approach to understanding organizations in their socio-historical contexts from a variety of theoretical perspectives in communication. Explores meanings, roles, relations, interactions, and structures from a communication perspective.
Credits: 3.0  
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): UN 1002 or UN 1003

HU 3850 - Cultural Studies
Examines the way that culture communicates values, feelings, beliefs; structures differential relations of power and possibility; creates difference and hierarchy. Considers the struggles over meaning that open up possibilities for diversity and change.
Credits: 3.0  
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): UN 1002 or UN 1003

HU 3860 - Popular Culture
Explores specific examples of popular culture that reveal how popular values, feelings, and beliefs are created and maintained. Considers the historical, social, political, and economic contexts of popular culture from a communication perspective.
Credits: 3.0  
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): UN 1002 or UN 1003

HU 3871 - Media and Communication 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: Fall

HU 3880 - Communication and Community
Examines community building as a communicative process. Students develop an awareness of themselves as cultural beings whose practices and worldviews influence the contours and possibilities of community.
Credits: 3.0  
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall - Offered alternate years beginning with the 2004-2005 academic year
Pre-Requisite(s): UN 1002 or UN 1003

HU 3890 - Documentary
Considers representations of cultural experience, focusing on written, photographic, filmic, and audio approaches to documentary in an effort to better understand the ways people struggle to grasp and explain the contradictions and instability of cultural life.
Credits: 3.0  
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): UN 1002 or UN 1003

HU 3910 - Language Issues in the World
A consideration of particular issues of language use in the world today. Topics considered may include endangered languages and the future of English; how technology relates to discourse; how language is used in academia; how power is created, enacted and maintained through language; gender variation in language; etc.
Credits: 3.0  
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring, Summer
Pre-Requisite(s): UN 1002 or UN 1003

HU 4050 - Special Topics
Tutorial, seminar, workshop, or class study of special interest and importance in the humanities. Students should register by section number for the appropriate instructor and topic.
Credits: variable to 6.0; May be repeated
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of instructor required

HU 4060 - Humanities Workshop
Special workshop projects in the humanities such as tutorials, editing, Shakespeare Faire drama workshop, writer’s workshop, or study-abroad tours. Approved credit varies by degree program.
Credits: variable to 6.0; May be repeated
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of instructor required

HU 4071 - Liberal Arts Capstone Project
A one-semester research project which demonstrates the skills in and knowledge of one or more disciplines covered by the major. Work is carried out under the supervision of a faculty advisor and results in a project that includes a writing component of substantial length.
Credits: 3.0  
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring
Restrictions: Must be enrolled in one of the following Major(s): Liberal Arts; May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior

HU 4101 - Writing Center Practicum
Reflective practicum in which theories of learning, literacy, and cultural differences are applied in the writing center setting under the supervision of a writing center professional.
Credits: 1.0; May be repeated
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Fall
Restrictions: Permission of instructor required
Pre-Requisite(s): UN 1001 and (UN 1002 or UN 1003) and UN 2001(C)

HU 4110 - Advanced Creative Writing
Intensive practice in one of the major creative genres, including poetry, short fiction, and literary nonfiction. The class combines workshops with small group work and individual conferences with the goal of producing several pieces of creative work polished to publication standards.
Credits: 3.0  
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2001-2002 academic year
Pre-Requisite(s): HU 2110 and UN 2001(C)

HU 4130 - Special Topics in Rhetoric or Composition
An in-depth examination of selected problems, issues, periods, theorists, or concepts in rhetoric (such as rhetoric and the environment, feminist rhetoric, the rhetoric of science, classical rhetoric, the Sophists, argumentation theory) or composition studies (such as literacy practices in social contexts, voice, composing processes, world Englishes, computers and writing).
Credits: 3.0  
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2000-2001 academic year
Pre-Requisite(s): HU 2110 and UN 2001(C)

HU 4140 - Methods of Teaching English
Application of learning theories and national and state professional standards to the teaching of English. Emphasizes methods, materials, and media used to teach adolescents. Requires admission to teacher education program or permission of instructor.
Credits: 4.0  
Lec-Rec-Lab: (0-3-3)
Semesters Offered: Fall
Restrictions: Permission of department required
Pre-Requisite(s): ED 3110 and ED 3210 and ED 3410 and ED 4700(C)

HU 4150 - Literacy in the Content Areas
Introduction to the best ways to use language for deepening comprehension and understanding in all content areas. 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

Undergraduate Course Descriptions, 2007-08, Page 54 of 86
HU 4271 - Modern Language Seminar I-French
Language and power. Critical study of the representation of politics, economics, and social institutions in literature, film, and authentic documents from French, German, and Hispanic language communities. Students read texts in French and in English translation.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): (HU 3274 or HU 3275) and UN 2002

HU 4272 - Modern Language Seminar II-French
Individual and society. Critical study of the relationship between the individual and social institutions in literature, film, and authentic documents from French, German, and Hispanic language communities. Students read texts in French and in English translation.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: 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 relationship between modern technology and literature, film, and authentic documents from French, German, and Hispanic language communities. Students read texts in French and in English translation.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): HU 3284 or HU 3285

HU 4281 - Modern Language Seminar I-German
Language and power. Critical study of the representation of politics, economies, and social institutions in literature, film, and authentic documents from French, German, and Hispanic language communities. Students read texts in German and in English translation.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: (HU 3284 or HU 3285) and UN 2002

HU 4282 - Modern Language Seminar II-German
Individual and society. Critical study of the relationship between the individual and social institutions in literature, film, and authentic documents from French, German, and Hispanic language communities. Students read texts in German and in English translation.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2001-2002 academic year
Pre-Requisite(s): HU 3284 or HU 3285

HU 4283 - Modern Language Seminar III-German
Technology in literature and film. Critical study of the relationship between modern technology and literature, film, and authentic documents from French, German, and Hispanic language communities. Students read texts in French and in English translation.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): HU 3284 or HU 3285

HU 4542 - Topics in American Literature
Selected problems posed by literary genres, themes, movements, and individual authors in American literature.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2001-2002 academic year
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): UN 1002 or UN 1003

HU 4625 - Risk Communication
Examines models for communicating risks associated with environmental, safety, and health hazards. Considers the diverse roles assumed by the public under each of these models and means of ensuring that risks are communicated fairly, honestly, and accurately.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring, Summer
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): UN 2002

HU 4628 - Usability and Instructions Writing
The role of readability and usability in technical communication. Topics include social, cultural, and cognitive theories of reading processes, navigation, print and online document design. Applies readability and usability testing techniques to typical print materials as well as online documents, digital libraries or databases, multimedia, or software interfaces.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2000-2001 academic year
Pre-Requisite(s): HU 3274 or HU 3275

HU 4630 - Teaching with Technology Across the Curriculum
Designed to explore use of technology-rich environments in improvement of teaching and learning and how such environments should be designed, implemented, and assessed. Includes introduction to internet, video and audio, presentation, and online assessment/portfolio technologies.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Fall

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 such as sets of procedures, proposals, progress reports, sets of directions, and style sheets. The course will also require students to complete, with advice from the instructor, one major client-involved project such as a brochure, newsletter, web site, technical training module, etc.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring
Restrictions: Must be enrolled in one of the following Major(s): Scientific & Tech Comm (BA), Scientific & Tech Comm (BS)
Pre-Requisite(s): HU 3120 and HU 2600

HU 4640 - Professional Development and Technological Practicum C
Designed to explore use of technology-rich environments in improvement of teaching and learning and how such environments should be designed, implemented, and assessed. Includes introduction to internet, video and audio, presentation, and online assessment/portfolio technologies.
Credits: 3.0
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Fall, Spring
Restrictions: Must be enrolled in one of the following Major(s): Liberal Arts, Scientific & Tech Comm (BA), Scientific & Tech Comm (BS)
Pre-Requisite(s): HU 2640 and HU 3640

HU 4642 - Special Topics in Advanced Media Development
Critical and practical topics in the quickly changing media of our time. Topics may include digital photography, advanced multimedia development, advanced graphic design, color theory, or three-dimensional modeling and rendering.
Credits: 3.0
Lec-Rec-Lab: (0-2-3)
Semesters Offered: Spring
Restrictions: Permission of instructor required
Pre-Requisite(s): UN 1002 or UN 1003

HU 4690 - Special Topics in Technical Communication
In-depth examination of selected topics in scientific and technical communication.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2000-2001 academic year
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: (0-3-2)
Semesters Offered: Fall, Spring, Summer

MA 1135 - Calculus for Life Sciences
Topics include analytic geometry, limits, continuity of functions, transcendental functions, derivatives, integrals, and applications of the derivative in the fields of economics, biological sciences, and social sciences. Extensive use of graphing calculator. (See mathematical sciences department for recommended calculator). Credit applicable only to those curricula specifying this course.
Credits: 4.0
Lec-Rec-Lab: (0-4-0)
Semesters Offered: Fall, Spring
Pre-Requisite(s): MA 1032 or MA 1031

MA 1140 - Technical Calculus I
Topics include derivatives of functions, including transcendental and implicit functions, and an introduction to integration with applications in technology and business. This course is intended for non-engineering majors and will focus on applications.
Credits: 4.0
Lec-Rec-Lab: (0-4-0)
Semesters Offered: Fall, Spring, Summer
Restrictions: Must be enrolled in one of the following Major(s): Business Administration, Economics, Business, Audio Production & Technology, Theatre & Entertain Tech (BS), Sound Design, Theatre & Entertain Tech (BA), Electrical Eng Tech (BS), Mechanical Engineering Tech, Engineering Technology, Civil Engineering Technology, Construction Management, Computer Network & System Admin, Electrical Eng Tech (AAS), Electromechanical Eng Tech, Industrial Technology
Pre-Requisite(s): MA 1031 or MA 1032

MA 1160 - Calculus with Technology I
An introduction to single-variable calculus, which includes a computer laboratory. Topics include trigonometric, exponential, and logarithmic functions, differentiation and its uses, and basic integration. Integrates symbolic tools, graphical concepts, data and numerical calculations.
Credits: 4.0
Lec-Rec-Lab: (0-4-0)
Semesters Offered: Fall, Spring, Summer
Restrictions: Must be enrolled in one of the following Major(s): Business Administration, Economics, Business, Audio Production & Technology, Theatre & Entertain Tech (BS), Sound Design, Theatre & Entertain Tech (BA), Electrical Eng Tech (BS), Mechanical Engineering Tech, Engineering Technology, Civil Engineering Technology, Construction Management, Computer Network & System Admin, Electrical Eng Tech (AAS), Electromechanical Eng Tech, Industrial Technology
Pre-Requisite(s): MA 1032 or MA 1031

MA 1161 - Calculus Plus w/ Technology I
An introduction to single-variable calculus, which includes a computer laboratory. Topics include trigonometric, exponential, logarithmic functions, differentiation and its uses, and basic integration. Integrates symbolic tools, data and numerics, and graphical concepts and is similar to MA1160, going at a slower pace and incorporating cooperative learning study skills.
Credits: 5.0
Lec-Rec-Lab: (0-5-0)
Semesters Offered: Fall, Spring
Pre-Requisite(s): MA 1032 or MA 1031

MA 1190 - 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, where 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 1200 - 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, where 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

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 1030

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): Theatre & Entertain Tech (BA), Humanities, Comm and Culture Studies, Liberal Arts, Psychology, Social Sciences, Liberal Arts with History Opt, Scientific & Tech Comm (BA), Scientific & Tech Comm (BS)

MA 1030 - College Algebra I
Part one of a two semester series for students whose algebraic preparation is not sufficient for MA1032. Topics include numerical pre-algebra skills (fractions and decimals) and basic algebra skills (exponents, polynomials, rational expressions, roots, equations and inequalities).
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring, Summer
Co-Requisite(s): MA 0030
MA 1930 - Exploring Number Theory
Mathematical discovery and invention in number theory: number puzzles, Chinese Remainder Theorem, codes, primitive roots, and quadratic reciprocity. Develops the ability to find and describe patterns, to generalize from observations, to formulate conjectures, and to support conjectures with analysis and, when possible, formal proof.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall - Offered alternate years beginning with the 2006-2007 academic year

MA 1940 - Exploring Non-Euclidean Geometry
Mathematical discovery and invention in Non-Euclidean geometry: definitions of straight and angle, transformations, congruence, parallel transport, projections, and finite geometries. Develops the ability to find and describe patterns, to generalize from observations, to formulate conjectures, and to support conjectures with analysis and, when possible, formal proof.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall - Offered alternate years beginning with the 2003-2004 academic year

MA 2010 - Recreational Mathematics
Topics include such things as fair division, time travel, maze threading, logic puzzles and paradoxes, famous math problems and solutions, 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: Spring - Offered alternate years beginning with the 2001-2002 academic year

MA 2140 - Technical Calculus II
Topics include methods of integration, applications of integration in technology and business, and arithmetic and geometric sequences and series. This course is intended for non-engineering majors and will focus on applications.
Credits: 4.0
Lec-Rec-Lab: (0-4-0)
Semesters Offered: Fall, Spring, Summer
Restrictions: Must be enrolled in one of the following Major(s): Business Administration, Economics, Business, Audio Production & Technology, Theatre & Entertain Tech (BS), Sound Design, Theatre & Entertain Tech (BA), Electrical Eng Tech (BS), Mechanical Engineering Tech, Engineering Technology, Civil Engineering Technology, Construction Management, Computer Network & System Admin, Electrical Eng Tech (AAS), Electromechanical Eng Tech, Industrial Technology
Pre-Requisite(s): MA 1140 or MA 1160 or MA 1161 or MA 1135

MA 2160 - Calculus with Technology II
Continued study of calculus, which includes a computer laboratory. Topics include integration and its uses, function approximation, vectors, and elementary modeling with differential equations.
Credits: 4.0
Lec-Rec-Lab: (0-4-0)
Semesters Offered: Fall, Spring, Summer
Pre-Requisite(s): MA 1140 or 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 MA2321 or MA2330.
Credits: 2.0
Lec-Rec-Lab: (0-2-0)
Semesters Offered: Fall, Spring, Summer
Restrictions: May not be enrolled in one of the following Major(s): Computer Science, Mathematics
Pre-Requisite(s): MA 1160 or MA 1161 or MA 1140

MA 2321 - Elementary Linear Algebra
Offered first half of semester, to be taken concurrently with MA3521. The course is an introduction to linear algebra and how it can be used. Topics include systems of equations, vectors, matrices, orthogonality, subspaces and the eigenvalue problem. Not open to students with credit in MA2320 or MA2330.
Credits: 2.0
Lec-Rec-Lab: (0-4-0)
Semesters Offered: Fall, Spring
Restrictions: May not be enrolled in one of the following Major(s): Computer Science, Mathematics
Pre-Requisite(s): MA 1140 or MA 1160 or MA 1140

MA 2330 - Introduction to Linear Algebra
An introduction to linear algebra and how it can be used, including basic mathematical proofs. Topics include systems of equations, vectors, matrices, orthogonality, subspaces, and the eigenvalue problem. Not open to students with credit in MA2320 or MA2321. Course prerequisite is any math class numbered MA1090 or higher.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring
Pre-Requisite(s): MA 1140 or MA 1160 or MA 1161

MA 2710 - Introduction to Statistical Analysis
Introduction to statistical reasoning and methods. Topics include uses and abuses of statistics, sources of data and data quality, graphical and descriptive methods, correlation and regression, probability and statistical inference. Labs involve data generation and analysis aided by statistical software. Not open to students with credit in MA2720 or MA3710.
Credits: 3.0
Lec-Rec-Lab: (0-2-1)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Major(s): Mathematics
Pre-Requisite(s): MA 1140 or MA 1160 or MA 1161

MA 2720 - Statistical Methods
Introduction to the design and analysis of statistical studies. Topics include methods of data collection, descriptive and graphical methods, probability, statistical inference on means, regression and correlation, and single variable ANOVA. Not open to students with credit in MA3710.
Credits: 4.0
Lec-Rec-Lab: (0-4-0)
Semesters Offered: Fall, Spring, Summer
Restrictions: May not be enrolled in one of the following Major(s): Mathematics
Pre-Requisite(s): MA 1020 or MA 1032 or MA 1031 or MA 1033

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, formal 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: Fall, Spring, Summer
Pre-Requisite(s): MA 1140 or MA 1160 or MA 1161 or MA 1135

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: (0-4-0)
Semesters Offered: Fall, Spring, Summer
Pre-Requisite(s): MA 2160 or MA 2140

MA 3202 - Introduction to Coding Theory
Transmission via noisy channels, hamming distance, linear codes, the ISBN-code, encoding and decoding, finite fields, Reed-Solomon codes, deep space communication, the compact disk code, sphere packing bound, hamming codes, hamming decoding.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring
Pre-Requisite(s): MA 2320 or MA 2321 or MA 2330

MA 3203 - Introduction to Cryptography
Topics include private-key cryptography, shift substitution, permutation and stream ciphers, cryptanalysis, perfect secrecy, public-key cryptography, and the RSA cryptosystem.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring, Summer
Pre-Requisite(s): MA 2320 or MA 2321 or MA 2330

MA 3210 - Introduction to Combinatorics
Topics include set theory, mathematical induction, integers, functions and relations, counting methods, recurrence relations, generating functions, permutations, combinations, principle of inclusion and exclusion, graphs (including planar graphs). Further possible topics are graph coloring, trees and cut-sets, combinatorial designs, Boolean algebra.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): MA 2320 or MA 2321 or MA 2330
MA 3310 - Introduction to Abstract Algebra
An intuitive introduction to groups, rings, and fields. Topics include set theory, functions, integral domains, Euclidean algorithm, congruence relations, finite fields, polynomial rings, symmetry groups, permutations, subgroups, cyclic groups, cosets, normal subgroups, homomorphisms, isomorphisms, introduction to group actions, and Burnside enumeration.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: 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: Fall, Summer
Pre-Requisite(s): MA 2320 or MA 2321 or MA 2330

MA 3520 - Elementary Differential Equations
First order equations, linear equations, and systems of equations. Not open to students with credit in MA3521, MA3530 or MA3560.
Credits: 2.0
Lec-Rec-Lab: (0-2-0)
Semesters Offered: Fall, Spring, Summer
Restrictions: May not be enrolled in one of the following Major(s): Computer Science, Mathematics
Pre-Requisite(s): MA 2160 and (MA 2320 or MA 2321 or MA 2330)

MA 3521 - Elementary Differential Equations
Offered second half of semester, to be taken concurrently with MA2321. Topics include first order equations, linear equations and systems of equations. Not open to students with credit in MA3520, MA3530 or MA3560.
Credits: 2.0
Lec-Rec-Lab: (0-4-0)
Semesters Offered: Fall, Spring
Restrictions: May not be enrolled in one of the following Major(s): Computer Science, Mathematics
Co-Requisite(s): MA 2321
Pre-Requisite(s): MA 2160

MA 3530 - Introduction to Differential Equations
First order equations, linear equations, systems of equations, and Laplace transforms. May include elementary separation of variables for partial differential equations. Not open to students with credit in MA3520, MA3531, 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 MA3560.
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 3720 - Probability
Introduction to probabilistic methods. Topics include probability laws, distribution theory, and limit theorems; elementary statistics, parameter estimation, reliability, introduction to random processes and their properties.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring
Pre-Requisite(s): MA 2160

MA 3810 - Introduction to Actuarial Mathematics
Covers measurement of interest, including accumulated and present values, nominal and effective rates of interest and discount. Annuities certain, including continuous increasing and decreasing cases. Calculation of yield rates, amortization schedules, and sinking funds. Introduction to life contingencies.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): MA 3160

MA 3811 - Actuarial Exam Workshop
Participants form a study group that meets weekly. Uses SOA exams and other materials to help prepare for the SOA course and examination.
Credits: 1.0; Graded Pass/Fail Only
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Fall, Spring
Pre-Requisite(s): MA 3160

MA 3910 - Techniques for Teaching Mathematics
Teaching strategies focus on the use of history, math manipulatives, problem solving, models, and technology in the secondary mathematics classroom.
Credits: 2.0
Lec-Rec-Lab: (0-1-2)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): MA 3924

MA 3924 - College Geometry with Technology
Review of Euclidean geometry. Introduction to geometric constructions, conjecturing of theorems, methods of proof, 3-D geometry, finite geometries, and non-Euclidean geometries. Integrates computer software (e.g. Geometer's Sketchpad) throughout the course.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): MA 2160 or MA 2330

MA 3930 - Theory of Games
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Pre-Requisite(s): MA 2320 or MA 2321 or MA 2330

MA 3990 - Math Sciences Teach Experience
Development of teaching skills through assisting in the instruction of a section of an entry-level undergraduate mathematics course. Students gain experience in leadership, group work, organization skills, cooperative exercise preparation, and class instruction.
Credits: variable to 4.0; Repeatable to a Max of 4; Graded Pass/Fail Only
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of instructor required

MA 4208 - Optimization and Graph Algorithms
An introduction to linear and integer programming and related graph problems. Topics include simplex algorithm, duality, branch-and-bound and branch-and-cut, shortest paths, spanning trees, matchings, network flow, graph coloring, and perfect graphs.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): MA 3210

MA 4209 - Combinatorics and Graph Theory
An introductory course in combinatorics and graph theory. Topics include designs, enumeration, extremal set theory, finite geometry, graph coloring, inclusion-exclusion, network algorithms, permutations, and trees.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): MA 3210

MA 4211 - Information Theory and Data Compression
An introduction to information theory and data compression. Topics include information and entropy, channel and channel capacity, Kraft-McMillan inequality, maximum likelihood decoding, reliability, Shannon's theorem, lossless data compression, arithmetic coding, higher order modeling, adaptive methods, dictionary methods, transform methods, and image compression.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2000-2001 academic year
Pre-Requisite(s): MA 3210

Undergraduate Course Descriptions, 2007-08, Page 58 of 86
MA 4310 - Abstract Algebra
Topics on groups, rings, and fields such as: group actions, the Sylow theorems, integral domains, factorization theory, Euclidean domains, principal ideal domains, splitting fields, zeros of irreducible polynomials, field extensions, and Galois theory.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
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, lead-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 - Offered alternate years beginning with the 2000-2001 academic year
Pre-Requisite(s): MA 3230 or MA 3231 or MA 3230 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: Fall
Pre-Requisite(s): MA 3160

MA 4426 - Differential Geometry
Geometrical properties of curves and surfaces, including the Frenet formulas, natural equations of curves, first and second fundamental forms, normal and Gaussian curvature, lines of curvature, geodesics, covariant derivatives, and parallel displacement. Tensors or differential forms with possible applications to Riemannian geometry, general relativity or other physical applications.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2000-2001 academic year
Pre-Requisite(s): MA 3160 and (MA 3520 or MA 3521 or MA 3530 or MA 3560)

MA 4450 - Real Analysis
Real analysis on Euclidean n-space. Topics include real and vector valued functions, metric and normed linear spaces; an introduction to Lebesgue measure and convergence theorems.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): MA 3450 and (MA 2320 or MA 2321 or MA 2330) and MA 3160

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)

MA 4520 - Integral Transforms, Special Functions, and Series Solutions to ODEs and Asymptotics
Laplace, Fourier, and other integral transforms and methods; special functions; series methods to solve ordinary differential equations.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2000-2001 academic year
Pre-Requisite(s): (MA 3520 or MA 3521 or MA 3530 or MA 3560) and MA 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 - Dynamical Systems: Control and Chaos
Ordinary differential equations and dynamical systems via a modern geometric approach, including physical and engineering applications. May include chaotic phenomena and fractals or elements of control theory.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall - Offered alternate years beginning with the 2000-2001 academic year
Pre-Requisite(s): (MA 3520 or MA 3521 or MA 3530 or MA 3560) and MA 3160

MA 4555 - Derivative Securities Models
Mathematical models to price-derivative securities, stochastic calculus. Computational methods for computing option prices. May include study of mathematical models of risk analysis, portfolio selection theory, futures, options, and other derivative investment instruments.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2000-2001 academic year
Pre-Requisite(s): (MA 3520 or MA 3521 or MA 3530 or MA 3560) and MA 3160

MA 4610 - Numerical Linear Algebra
Derivation and analysis of algorithms for problems in linear algebra. Covers floating point arithmetic, condition numbers, error analysis; solution of linear systems (direct and interative methods), eigenvalue problems, least squares, singular value decomposition. Includes a review of elementary linear algebra and the use of appropriate software.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): MA 3230 or MA 2321 or MA 2330

MA 4620 - Finite Difference Methods for PDEs
Derivation, analysis, and implementation of finite difference methods; applications to fluid mechanics, elasticity, heat conduction, acoustics, or electromagnetism. Difference equations, Taylor series, stability, and convergence. Finite difference methods for partial differential equations; alternate methods (spectral, finite element, or particle) for discretizing space.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): (MA 3520 or MA 3521 or MA 3530 or MA 3560) and MA 3160

MA 4625 - Finite Element Methods
Theory and practical applications of finite element methods in fluid mechanics, elasticity, heat transfer, and electricity and magnetism. Topics include variational principles, elementary function space concepts, finite element methodology, convergence, errors, and element selection.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): (MA 3520 or MA 3521 or MA 3530 or MA 3560) and MA 3160

MA 4630 - Numerical Methods
Solution of nonlinear equations in one variable, interpolation, polynomial approximation, numerical integration/differentiation, and numerical solution of initial-value problems.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): MA 3530

MA 4635 - Numerical Methods for Integral Equations
Includes quadrature and quadrature methods for solving integral equations that occur in many scientific disciplines (imaging, aerodynamics, etc.).
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall - Offered alternate years beginning with the 2000-2001 academic year
Pre-Requisite(s): (MA 3520 or MA 3521 or MA 3530 or MA 3560) and MA 3160

MA 4710 - Regression Analysis
Covers simple, multiple, and polynomial regression; estimation, testing, and prediction; weighted least squares, matrix approach, dummy variables, multicollinearity, model diagnostics and variable selection. A statistical computing package is an integral part of the course.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): MA 2720 or MA 3710
MA 4720 - Design and Analysis of Experiments
Covers construction and analysis of completely randomized, randomized block, incomplete block, Latin squares, factorial, fractional factorial, nested and split-plot designs. Also examines fixed, random and mixed effects models and multiple comparisons and contrasts. The SAS statistical package is an integral part of the course.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): MA 2710 or MA 2720 or MA 3710

MA 4730 - Nonparametric Statistics
Survey of distribution free statistical inference procedures. Topics include a review of probability and distribution theory, one sample, paired samples, multi-sample location tests, tests of independence and related measures of association, goodness-of-fit tests and tests based on the cumulative distribution function.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): MA 2710 or MA 2720 or MA 3710

MA 4740 - Sampling Methods
Topics include survey construction, sources of error in surveys, estimation of population parameters from simple random, stratified, systematic, and multi-stage samples, effects of and remedies for non-response, hypothesis testing survey data, and other topics as time permits. Students cannot receive credit for both MA4740 and MAS740.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand

MA 4750 - Applied Multivariate Statistics
An introduction to analysis of multidimensional data with emphasis on applications. Topics include inference for multivariate normal distribution, classification, cluster analysis, dimension reduction.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior

MA 4760 - Mathematical Statistics I
Covers probability set functions and distributions, multivariate distributions, special distributions, distributions of functions of random variables, and limiting distributions.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): MA 3720

MA 4770 - Mathematical Statistics II
Point estimation, confidence intervals, sufficient statistics, Bayesian estimation, the Rao-Cramer inequality, hypothesis testing, including optimal tests, nonparametric methods.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): MA 4760

MA 4810 - Life Contingencies
Measurement of mortality, life tables, commutation functions. Covers all basic forms of life insurance and life annuities, including gross and net premiums, reserves, cash values, and expense loadings. Advanced topics may include stationary populations, joint and multiple life functions, multiple decrement tables and dividends.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2004-2005 academic year
Pre-Requisite(s): MA 3720 or MA 3810

MA 4820 - Loss Distributions and Credibility Theory
Credibility theory addresses methods for updating statistical estimates as new data becomes available. Loss distribution studies probability distributions that are used for modeling the outcomes of insurance claims.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2005-2006 academic year
Pre-Requisite(s): MA 3720

MA 4900 - Mathematical Sciences Project
Independent study in an area of mathematical sciences under the guidance of a faculty member.
Credits: variable to 4.0; Repeatable to a Max of 6
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of instructor required

MA 4908 - Theory of Numbers with Technology
Mathematical induction, Euclid's algorithm, prime and composite integers, algebra of congruences, Chinese remainder theorem, quadratic reciprocity law, number theoretic functions, first degree Diophantine equations, Pythagorean triples, Fermat and Mersenne numbers, factoring algorithms, tests for primality and various applications. Projects use Mathematica and EXCEL software packages.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Spring
Pre-Requisite(s): MA 3210 or MA 3310 or MA 3924

MA 4945 - History of Mathematics
Survey of the development of mathematics from ancient times to today. How cultural, mathematical, and technological developments have influenced one another throughout history. Course provides all necessary historical background.
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

Mechanical Engineering - Engineering Mechanics

MEEM 1500D - Mechanical Engineering Problem Solving
Introduces students to the use of a higher level programming language. Examples of the application of the language to the solution of problems in mechanical engineering are emphasized. Applications include indexing loops, arrays, logical operations, control flow, and output manipulation including two and three dimensional graphics.
Credits: 1.0
Lec-Rec-Lab: (0-1-0)
Semesters Offered: On Demand

MEEM 2110 - Statics
Force systems in two and three dimensions. Includes composition and resolution of forces and force systems, principles of equilibrium applied to various bodies, simple structures, friction, centroids, and moments of inertia. Vector algebra used where appropriate.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring, Summer
Restrictions: Must be enrolled in one of the following College(s): College of Engineering, Sch of Forest Res & Envir Sci
Pre-Requisite(s): MA 2160

MEEM 2111D - Statics for Design (Distance Program)
Force systems in two and three dimensions. Includes composition and resolution of forces and force systems, principles of equilibrium applied to various bodies, simple structures, friction, centroids, and moments of inertia.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring, Summer
Pre-Requisite(s): MA 2160

MEEM 2150D - 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): College of Engineering, Sch of Forest Res & Envir Sci
Pre-Requisite(s): MEEM 2110

MEEM 2151D - Mechanics of Materials for Design (Distance Program)
Introduction to mechanical behavior of materials, including stress/strain at a point, principle stresses and strains, stress-strain relationships, determination of stresses and deformations in situations involving axial loading, torsional loading of circular cross-sections, and flexural loading of straight members. Also covers stresses due to combined loading and buckling of columns.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Pre-Requisite(s): MEEM 2111D
MEEM 2200 - Thermodynamics
Introduces fundamental concepts of heat and power. Presents property relationships incompressible substances, simple pure substances, and ideal gases. Applies the first and second laws of thermodynamics to the analyses of processes for open and closed systems. Also covers thermodynamic cycles.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring, Summer
Restrictions: Must be enrolled in one of the following College(s): College of Engineering
Pre-Requisite(s): MA 2160 and (CH 1100 or CH 1110)

MEEM 2500 - Integrated Design and Manufacturing
Focuses on practical aspects of design and manufacturing. Covers fundamentals of manufacturing processes and includes weekly lab providing hands-on experiences with manufacturing issues that influence component design. Incorporates computer-aided manufacturing tools.
Credits: 4.0
Lec-Rec-Lab: (0-3-3)
Semesters Offered: Fall, Spring
Restrictions: Must be enrolled in one of the following Major(s): Engineering, Engineering-Mechanical Design, Engineering-Manufacturing, Mechanical Engineering, Biomedical Engineering
Pre-Requisite(s): ENG 1102 and MY 2100(C)

MEEM 2700 - Dynamics
First course in the principles of dynamics, covering the motion of a particle, the kinematics and kinetics of plane motion of rigid bodies, the principles of work and energy, impulse and momentum. Uses vector methods.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring, Summer
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(C) or ENG 2120) and ME 3230(C) and ME 3700(C) and EE 3010

MEEM 3210 - Fluid Mechanics
Presentation/development of the fundamentals of fluid dynamics, building on students' background in mechanics and thermodynamics. Makes applications to fluid statics, incompressible flows with friction (viscosity) and compressible flows without friction. Covers nondimensional representation of experimental results, power requirements for pumps and turbines, and energy losses in pipes.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring, Summer
Pre-Requisite(s): MEEM 2200 and MEEM 2700(C)

MEEM 3220 - Energy Laboratory
Introduction to transducers and the use of transducers to reinforce knowledge in the application of the principles of thermodynamics, fluid mechanics, and heat transfer.
Credits: 1.0
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring, Summer
Restrictions: Must be enrolled in one of the following Major(s): Mechanical Engineering
Pre-Requisite(s): MEEM 3220
Pre-Requisite(s): MEEM 2200

MEEM 3320 - Heat Transfer
Covers fundamental principles of steady-state and transient heat transfer, including conduction, convection, and radiation. Also covers applications to heat exchangers and extended surfaces.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring, Summer
Pre-Requisite(s): MEEM 3210 and (MA 3520 or MA 3521 or MA 3530 or MA 3560)

MEEM 3501 - Product Realization I
Students apply mechanical synthesis, analysis, and manufacturing processes to the design of products, using case studies of existing products to develop the relationships between design, manufacturing, and product performance. They apply synthesis methods to the design of a new product.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring, Summer
Pre-Requisite(s): MEEM 2700 and MEEM 2150 and MEEM 2500 and (MA 2320(C) or MA 2321(C) or MA 2330(C))

MEEM 3502 - Product Realization II
Students apply design and manufacturing principles to a complete mechanical system, using synthesis and analysis software, SPC, design for manufacturing, and assembly techniques in the redesign of various consumer products.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring, Summer
Pre-Requisite(s): MEEM 3501 and (MA 3520(C) or MA 3521(C) or MA 3530(C))

MEEM 3700 - Mechanical Vibrations
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring, Summer
Pre-Requisite(s): Permission of instructor required; Must be enrolled in one of the following Major(s): Mechanical Engineering, Mechanical Eng-Eng Mechanics; May not be enrolled in one of the following Class(es): Freshman, Sophomore, Senior

MEEM 4150 - Intermediate Mechanics of Materials
Basic concepts of three-dimensional stress and strain. Inelastic behavior of axial members, circular shafts and symmetric beams. Reflections of indeterminate beams. Unsymmetrical bending, shear flow and shear center for open sections. Energy methods for structures made up of one-dimensional elements. Introduction to theories of failures for anisotropic materials.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): MEEM 2150

MEEM 4160 - Fund of Exp Stress Analysis
Transmits basic understanding of purposes and uses of experimental stress analysis and makes students familiar with methods used in the field to give experience in either design or analysis of strain- gauged transducer.
Credits: 3.0
Lec-Rec-Lab: (0-2-3)
Semesters Offered: Fall
Pre-Requisite(s): MEEM 2150

MEEM 4170 - Failure of Material in Mechanics
Identifies the modes of mechanical failure that are essential to prediction and prevention of mechanical failure. Discusses theories of failure in detail. Treats the topic of fatigue failure extensively and brittle fracture, impact and buckling failures at some length.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): MEEM 3501

MEEM 4180 - Engineering Biomechanics
Engineering mechanics applied to the human body in health and disease or injury, which includes mechanics of human biological materials and engineering design in musculoskeletal system. Also studies on mechanics of posture (occupational biomechanics) and locomotion (sports biomechanics) using mathematical models of the human body.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): MEEM 2150 and MEEM 2700
MEEM 4200 - Principles of Energy Conversion
Introduces basic background, terminology, and fundamentals of energy conversion. Discusses current and emerging technologies for production of thermal, mechanical, and electrical energy. Topics include fossil and nuclear fuels, solar energy, wind turbines, fuel and solar cells.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2005-2006 academic year
Pre-Requisite(s): MEEM 3230(C)

MEEM 4210 - Computational Methods in Thermal Sciences
Introduces computational methods used to solve thermodynamic, fluid mechanic, and heat transfer problems. Discusses theoretical and practical aspects. Modern computer-based tools are used to reinforce principles and introduce advanced topics in thermodynamics, fluid mechanics, and heat transfer.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): MEEM 3230(C)

MEEM 4220 - Internal Combustion Engines I
Teaches the operation and design of various types of internal combustion engines through the application of applied thermodynamics, cycle analysis, combustion, mixtures of gases, fluid dynamics, and heat transfer.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): MEEM 3210

MEEM 4240 - Combustion & Air Pollution
Introduces physico-chemical processes of combustion, including the phenomena of ignition, extinction, flame propagation, detonation, solid propelant combustion, fuel spray combustion, and pollutant formation. Also addresses analysis and design of an air pollution control system with a special focus on automotive emissions.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following College(s): College of Engineering; May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior
Pre-Requisite(s): MEEM 2200

MEEM 4250 - Heating/Ventilation/Air Cond
Elements of heat transfer for buildings. Thermodynamic properties of moist air, human comfort and the environment, solar energy fundamentals and applications, water vapor transmission in building structures, heating and cooling load calculations.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2004-2005 academic year
Pre-Requisite(s): MEEM 3230(C)

MEEM 4403 - Computer-Aided Design Methods
Students apply fundamental and advanced solid modeling techniques to construct solid models of mechanical systems, simulate the motion of the system, and document the design. Students use shared data to function in a concurrent design environment and identify major functional features of commercial CAD software.
Credits: 4.0
Lec-Rec-Lab: (3-0-2)
Semesters Offered: Fall, Spring, Summer
Restrictions: Must be enrolled in one of the following Major(s): Mechanical Engineering, Engineering-Manufacturing, Mechanical Eng-Eng Mechanics; May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): ENG 1102

MEEM 4403D - Computer-Aided Design Methods (Distance Program)
Students apply fundamental and advanced solid modeling techniques to construct solid models of mechanical systems, simulate the motion of the system, and document the system's design. Students use shared data to function in a concurrent design environment and identify major functional features of commercial CAD software.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring, Summer
Restrictions: Must be enrolled in one of the following College(s): College of Engineering
Pre-Requisite(s): ENG 1102

MEEM 4404 - Mechanism Syn/Dynamic Modeling
Students apply kinematic synthesis techniques in design and analysis of mechanical systems. They develop synthesis software to link to dynamic analysis packages such as ADAMS, I-DEAS, Unigraphics, etc. They investigate influences of process variation on system output and learn methods to minimize the variation influences.
Credits: 4.0
Lec-Rec-Lab: (0-3-2)
Semesters Offered: Spring
Pre-Requisite(s): MEEM 3902(C)

MEEM 4404D - Mechanism Syn/Dynamic Modeling (Distance Program)
Students apply kinematic synthesis techniques in design and analysis of mechanical systems. They develop synthesis software to link to dynamic analysis packages such as ADAMS, I-DEAS, Unigraphics, etc. They investigate influences of process variation on system output and learn methods to minimize the variation influences.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring, Summer
Pre-Requisite(s): MEEM 3902(C)

MEEM 4405 - Intro to the Finite Element Method
Introduces the use of the finite element method in stress analysis and heat transfer. Emphasizes the modeling assumptions associated with different elements and uses the computer to solve many different types of stress analysis problems, including thermal stress analysis and introductory nonlinear analysis.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Fall, Spring, Summer
Pre-Requisite(s): MEEM 3502 and (MA 2320 or MA 2321 or MA 2330) and (MA 3520 or MA 3521 or MA 3530 or MA 3560)

MEEM 4610 - Advanced Machining Processes
Covers mechanics of 2-D and 3-D cutting and their extension to commonly used conventional processes such as turning, boring, milling, and drilling. Topics include force modeling, surface generation, heat transfer, tool life and dynamics.
Credits: 4.0
Lec-Rec-Lab: (0-3-2)
Semesters Offered: Spring
Pre-Requisite(s): MEEM 2500

MEEM 4610D - Advanced Machining Processes
Covers mechanics of 2-D and 3-D cutting and their extension to commonly used conventional processes such as turning, boring, milling, and drilling. Topics include force modeling, surface generation, heat transfer, tool life and dynamics. Credit may not be received for more than one of the following: MEEM 4610, 4610D and 5610.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Restrictions: Must be enrolled in one of the following Campus(s): Extended University Programs
Pre-Requisite(s): MEEM 2500

MEEM 4615 - Metal Forming Processes
Covers analytical and experimental study of metal forming processes, such as forging, extrusion, rolling, bending, stretch forming, and deep drawing as well as progressive die design for sheet metal stamping and design of dies for bulk forming.
Credits: 4.0
Lec-Rec-Lab: (0-3-2)
Semesters Offered: Fall
Pre-Requisite(s): MEEM 2500 and MEEM 2150

MEEM 4615D - Metal Forming Processes (Distance Program)
Covers analytical and experimental study of metal forming processes, such as forging, extrusion, rolling, bending, stretch forming, and deep drawing as well as progressive die design for sheet metal stamping and design of dies for bulk forming.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Pre-Requisite(s): MEEM 2500 and MEEM 2150

MEEM 4625 - Precision Manuf and Metrology
Course presents theory and practice involved in manufacturing and measuring of precision components. Topics include precision machining processes, precision machine/mechanism design, and dimensional metrology. Also discusses current manufacturing challenges in the bearings, optics, and microelectronics industries.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Fall
Pre-Requisite(s): MEEM 3700(C) and MEEM 3502(C)

MEEM 4635 - Design with Plastics
Covers various complexities in design of plastic parts and design of molds for manufacturing of plastic parts.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring
Pre-Requisite(s): MY 2100 and MEEM 2150 and MEEM 3210 and MEEM 3230(C)
MEEM 4640 - Micromanufacturing Processes
Introduces the processes and equipment for fabricating microsystems and the methods for measuring component size and system performance. Fabrication processes include microscale milling, drilling, diamond machining, and lithography. Measurement methods include interferometry and scanning electron microscopy.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Fall, Spring
Pre-Requisite(s): MEEM 3502(C)

MEEM 4650 - Quality Engineering
Introduction to the concepts and methods of quality and productivity improvement. Topics include principles of Shewhart, Deming, Taguchi, meaning of quality; control charts for variables, individuals, and attributes; process capability analysis; variation of assemblies; and computer-based workshops. Credit may not be received for both MEEM4650 and MEEM5650.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): MA 3710 or MA 3720

MEEM 4655 - Production Planning
Provides current issues, such as just-in-time production and reengineering, while covering fundamental production planning topics as scheduling, job design, inventory and forecasting. Provides the fundamental essence of the firm—how its products are made and how they are delivered to customers.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, 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: (0-2-3)
Semesters Offered: Fall, Spring, Summer
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): MEEM 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
Pre-Requisite(s): MEEM 4700(C)

MEEM 4900 - Senior Design I
Students work in teams on "open-ended" engineering design projects - most with industrial sponsors - developing original and creative solutions to real engineering problems. Lectures include the design process, design tools, project management, engineering communication/oral/written), engineering ethics, and intellectual property.
Credits: 3.0
Lec-Rec-Lab: (2-0-3)
Semesters Offered: Fall
Pre-Requisite(s): MEEM 3000(C) and MEEM 3502(C)

MEEM 4900D - Senior Design I
Introduces computer-aided design (CAD) and finite element methods as tools for engineering design. Senior projects are selected/assigned with initial concepts evaluated using CAD methods. Covers project management methods and emphasized communications, oral and written
Credits: 3.0
Lec-Rec-Lab: (2-0-3)
Semesters Offered: On Demand
Restrictions: Must be enrolled in one of the following Campus(s): Extended University Programs
Pre-Requisite(s): MEEM 4405 and MEEM 4992D and MEEM 4993D

MEEM 4910 - Senior Design II
Design projects started in MEEM4900 are completed and evaluated using computer-aided engineering methods, physical models, and/or prototypes as appropriate. Introduces evaluation and design optimization methods, enabling students to develop efficient and cost-effective designs. (Senior project ready as defined by major substitutes for prerequisites)
Credits: 3.0
Lec-Rec-Lab: (1-0-6)
Semesters Offered: Fall, Spring
Pre-Requisite(s): MEEM 4900

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 4991D - Solid Modeling (Distance Program)
Develops a working knowledge of parametric solid modeling techniques for building, modifying, and constraining virtual automotive components and assemblies, including the use of parametric constraints, feature creation and editing techniques, and development of freeform features.
Credits: 6.0
Lec-Rec-Lab: (0-6-0)
Semesters Offered: On Demand
MEEM 4992D - Vehicle Packaging (Distance Program)
Explores the designer's role in vehicle packaging issues and practices, such as drive/passenger ergonomics, engine compartment serviceability, and clearance parameters; door, deck and hood requirements; suspension and exhaust system considerations; heating/cooling system provisions and limitations; and fuel system factors.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Pre-Requisite(s): (MEEM 4991D or ENG 1102) and (MA 1160 or MA 1040D)

MEEM 4993D - Design for Manufacturability (Distance Program)
Provides the background and concepts needed to select and apply the various methodologies and techniques of Design for Manufacturability (DFM) to the design of automotive components and systems as a means of improving the manufacturing effectiveness, productivity, and reducing cost.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Pre-Requisite(s): MEEM 2500 and MEEM 4992D and MY 2100

MEEM 4994D - Powertrain Packaging
Explores the designer's role in powertrain packaging issues and practices such as overview of major dynamic phenomenon that characterizes powertrain behavior. Emphasis on interaction between subsystems.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Pre-Requisite(s): (MEEM 4991D or MEEM 4403D) and (MEEM 2151D or MEEM 2150)

MEEM 4999 - Mechanical Engineering Senior Research Thesis
An undergraduate research experience during the senior year in mechanical engineering. Students begin work on an active research project/grant with faculty or continue work from the previous year. A thesis will be published in the department and archived.
Credits: 3.0; Repeatable to a Max of 6
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of instructor required; Must be enrolled in one of the following Major(s): Mechanical Engineering, Mechanical Eng-Eng Mechanics; May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior

Mechanical Engineering Technology

MET 1540 - Materials Science
Introduction to the fundamentals of materials. Introduces mechanical properties, phase diagrams, thermal processing, alloying, and corrosion. Examines material selection with regard to design considerations.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): CH 1000 or CH 1100

MET 2120 - Statics and Strength of Materials
The statics portion includes the study of forces, analysis of simple structures, equilibrium, centroids and moment of inertia, and friction. The materials portion considers stress and strain under axial, torsional, and bending loads. Laboratory exercises include statics problem solving, materials testing, report writing, and a discussion of materials and testing standards.
Credits: 4.0
Lec-Rec-Lab: (0-3-2)
Semesters Offered: Fall
Pre-Requisite(s): (MA 1140(C) or MA 1160(C) or MA 1161(C)) and PH 1140

MET 2130 - Dynamics
An introduction to particle and rigid plane body kinematics and kinetics for technology students. Inertia force, work-energy-power and impulse-momentum methods are applied. Emphasizes development of student skills in problem definition and problem solving.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): MET 2120

MET 2400 - Practical Applications in Parametric Modeling
Intermediate course intended to expand the student's knowledge of computer modeling techniques, introducing advanced assemblies and GDAIT concepts. Investigates advanced concepts available to the designer.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Fall, Summer
Restrictions: Must be enrolled in one of the following Major(s): Mechanical Engineering Technology; Must be enrolled in one of the following Class(es): Sophomore
Pre-Requisite(s): TE 1010

MET 3242 - Machine Design I
An introduction to the basic concepts of mechanical design for technology students. Applies principles of statics, dynamics and mechanics of materials to the design of mechanical components and simple systems.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): (MAT 2215 or MA 2140 or MA 2160) and MET 2130

MET 3250 - Applied Fluid Mechanics
Introduction to the basic principles of fluid statics and dynamics for technology students. Emphasizes applications in fluid transfer and fluid power, including selection of components for efficient system operation. A laboratory exposes students to current design and testing practices.
Credits: 4.0
Lec-Rec-Lab: (0-3-2)
Semesters Offered: Fall
Pre-Requisite(s): MET 2130

MET 3450 - Machine Design II
Extends the study of mechanical design that began in MET3242. Applies principles of statics, dynamics and mechanics of materials to the design of mechanical components and systems. Design project activities are heavily emphasized.
Credits: 4.0
Lec-Rec-Lab: (0-4-0)
Semesters Offered: Spring
Pre-Requisite(s): MET 3242

MET 3600 - Applied Thermodynamics
Introduction to engineering thermodynamic principles for technology students. Topics include work, heat and temperature, pure substances, closed and open systems, first and second laws of thermodynamics, power and refrigeration cycles.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): MET 3250

MET 4200 - Design of Experiments
This course provides basic knowledge required to develop statistical experiments to improve quality of process and products. The student will begin designing simple experiments and expand to apply advance principles to study interaction between variables. A strong foundation will be provided allowing the student to progress to Taguchi experimental design techniques.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Summer
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): MA 2720 or BA2100

MET 4300 - Applied Heat Transfer
Introduction to heat transfer principles for technology students. Topics include conduction, convection and radiation heat transfer mechanisms. Practical applications include thermal insulation, heat sink and heat exchanger design.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): MET 3600

MET 4377 - Applied Fluid Power
Covers hydraulic and pneumatic components and systems used in industrial and mobile applications. Includes component selection, open and closed loop circuit operation and design, electrical controls, system maintenance, noise and heat generation. Design projects are included.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Fall - Offered alternate years beginning with the 2007-2008 academic year
Pre-Requisite(s): MET 3250

MET 4390 - Internal Combustion Engines
An introduction to the basic principles and applications of internal combustion engines for technology students. Emphasizes design, development and testing of engine components and systems. A laboratory exposes students to current industry practices.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Spring - Offered alternate years beginning with the 2007-2008 academic year
Pre-Requisite(s): MET 3600(C) or MET 3361
MET 4400 - Simulation Methods
Introduction to computer simulation designed to model processes found in the manufacturing or service environment. Computer software will be used to model real life problems, analyze alternative solutions and generate recommendations. Projects involving local manufacturing and service situations will be modeled.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Spring
Pre-Requisite(s): MA 2720 or MA 2710 or MA 3710

MET 4460 - Product Design and Development
A treatment of design and development issues such as design for manufacturing, prototyping, industrial design, and customer needs. Presents integrated methodologies that examine marketing, manufacturing, and cross-functional teams. Includes concurrent engineering and projects utilizing CAD systems.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Fall, Spring
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): MET 3450

MET 4500 - Lean Manufacturing, Principles, Concepts and Applications
Provides an understanding of current concepts required to implement lean manufacturing in various manufacturing and service sectors. Focus is on the essentials required to provide products and services that meet customer demand with reduced lead times, elimination of waste and safety improvements.
Credits: 3.0
Lec-Rec-Lab: (2-0-2)
Semesters Offered: Spring - Offered alternate years beginning with the 2007-2008 academic year
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): MET 4550

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 - Offered alternate years beginning with the 2006-2007 academic year
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): MEEM 2500 and MET 2400

MET 4580 - Facilities Planning, Layout and Process Flow
Course works through the basics of site selection, plant layout, disaster control, energy conservation, and pollution abatement. Attention will be given to equipment selection, strategy and material flow.
Credits: 3.0
Lec-Rec-Lab: (0-2-1)
Semesters Offered: On Demand
Restrictions: Must be enrolled in one of the following Class(es): Senior
Pre-Requisite(s): MET 4500

MET 4590 - Production Planning and Control
Course includes essential activities associated with both service sector and manufacturing activities required to forecast, schedule and determine functional requirements to produce a product or service.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Restrictions: Must be enrolled in one of the following Class(es): Senior
Pre-Requisite(s): MET 4600

MET 4600 - Computer Aided Methods in Thermal Science
Course makes extensive use of modern computer based tools to solve problems in fluid mechanics, heat transfer and thermodynamics.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): MET 3450 and MET 4500

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: (0-2-3)
Semesters Offered: Spring - Offered alternate years beginning with the 2008-2009 academic year
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): MET 3600 or MET 3361

MET 4999 - Senior Project Seminar
Course designed to review and evaluate the program objectives linked with industrial partners and accreditation body. Focus given to preparing the student to take the PE (Professional Engineer) and/or the CMGT (Certified Manufacturing Technologist) exams.
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
Pre-Requisite(s): ENG 1101 or ENG 1100

Materials Science & Engineering

MY 2000 - Introduction to Materials Processing
Introduction to the science and technology of the production of primary and engineering materials. Topics include mineral processing, extractive metallurgy, casting, deformation processing, powder fabrication, thin film deposition, joining and machining. Demonstrations and laboratory exercises will be employed to highlight these processing techniques.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Spring
Pre-Requisite(s): ENG 1101 or ENG 1100

MY 2100 - Introduction to Materials Science and Engineering
Introduction to the structure, processing, properties, and performance of engineering materials, including metals, polymers, glasses, ceramics, and composites. Presents case studies covering selection of materials, component design, and analysis of component failures.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring, Summer
Pre-Requisite(s): CH 1100 or CH 1110

MY 3100 - Materials Processing I
Classical chemical thermodynamics as applied to single and multicomponent materials systems. Topics include heat and mass balance, enthalpy, entropy, free energy, chemical reactions and equilibria, mass action, solution thermodynamics, phase diagram, stability/Pourbaix diagrams and electrochemistry.
Credits: 4.0
Lec-Rec-Lab: (4-0-0)
Semesters Offered: Fall
Pre-Requisite(s): MY 2100

MY 3110 - Materials Processing II
A continuation of Materials Processing I, which introduces the fundamental theories and equations governing transport phenomena. Topics include fluid flow, heat flow, diffusion, and chemical kinetics. Discusses the relationships between these subjects and the thermodynamic concepts covered in Materials Processing I.
Credits: 4.0
Lec-Rec-Lab: (4-0-0)
Semesters Offered: Spring
Pre-Requisite(s): MY 3100
MY 3200 - Materials Characterization I
Fundamentals of microstructural and chemical characterization of materials. Examines the physical principles controlling the various basic characterization techniques. Topics include crystallography, optics, optical and electron microscopy, diffraction and spectroscopy. Laboratory focuses on proper operational principles of characterization equipment, which includes optical and other microscopy methods and various diffraction techniques.
Credits: 4.0
Lec-Rec-Lab: (2-1-3)
Semesters Offered: Fall
Pre-Requisite(s): MY 2100

MY 3210 - Materials Characterization II
Fundamentals of structural characterization. A continuation of Materials Characterization I which examines additional structural techniques such as thermal analysis, calorimetry, and particulate analysis, scanning tunneling and atomic force microscopy. Discusses the limitations/capabilities of basic characterization techniques as well as data analysis methods and practices.
Credits: 4.0
Lec-Rec-Lab: (2-1-3)
Semesters Offered: Spring
Pre-Requisite(s): MY 3200

MY 3300 - Design of Microstructure
Relates thermodynamic and kinetic principles to phase transformations and microstructural evolution. Topics include nucleation, solidification, precipitation, recrystallization, grain growth, and sintering. Applications of these concepts (e.g., heat treatment of steel, casting, powder processing, etc.) are presented and reinforced by laboratory exercises in the corequisite course Materials Characterization II.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Pre-Requisite(s): MY 3200

MY 3400 - Mechanical Properties of Materials
An introduction to the deformation and fracture behavior of metals, ceramics, polymers, and composites. Topics include yielding criterion, plastic deformation, strain hardening, strengthening mechanisms, viscoelasticity, fatigue, fracture, and microstructure/mechanical property relationships.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Pre-Requisite(s): MY 2100 and (MEEM 2150 or ENG 2120)

MY 3700 - Electronic, Optical, and Magnetic Properties of Materials
Provides background needed to understand how electrons and electromagnetic waves interact with materials. Topics include waves, bonding, phonons, bands, the basics of semiconducting, metallic, dielectric, optical, and magnetic material properties, and how elementary devices made from these materials operate.
Credits: 4.0
Lec-Rec-Lab: (3-1-0)
Semesters Offered: Fall
Pre-Requisite(s): (PH 2200 or PH 2260) and MA 3160 and (MA 3520 or MA 3530) or (MA 2321 and MA 3521)

MY 4130 - Principles of Metal Casting
Principles of metal casting, including melting practice, casting design, mold design, heat transfer and solidification, fluid flow and gating design.
Introduction to computer simulation techniques for mold filling, solidification, and development of residual stress. Structure-property relations in cast metals.
Recycling and environmental issues of the cast metal industry.
Credits: 3.0
Lec-Rec-Lab: (2-0-3)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): MY 2100

MY 4140 - Science of Ceramic Materials
The structure, defect chemistry, and properties of crystalline and amorphous ceramics. Utilization of these materials in a variety of applications such as electrolytes in fuel cells and as bioceramics are examined.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Pre-Requisite(s): MY 2100

MY 4150 - Composite Materials
Structure, processing and properties of composite materials based on combinations of metals, ceramics, and polymers.
Credits: 2.0
Lec-Rec-Lab: (2-0-0)
Semesters Offered: On Demand
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 - Offered alternate years beginning with the 2007-2008 academic year
Pre-Requisite(s): MY 2100

MY 4180 - Science and Engineering of Structural Metals
Examines what exactly makes a particular industrial alloy useful. From the light metals (aluminum, magnesium and titanium) to the heavy weights (nickel and high alloy steels), this course examines the structure, properties, and processing of metals into industrially useful materials. Covers internationally accepted alloy designations, heat treatment standards, modification and processing.
Credits: 3.0
Lec-Rec-Lab: (2-1-0)
Semesters Offered: 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
Practical training on the operation and image formation in a scanning electron microscope (SEM). Applications of the SEM to the analysis of metallic, ceramic, geological and biological materials are discussed, including qualitative chemical analysis using energy dispersive spectroscopy.
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

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

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

MY 4410 - Metal Forming
Introduction to metal forming, including rolling, forging, extrusion, drawing, stamping, and sheet metal forming. Covers practical aspects of manufacturing processes, as well as continuum-mechanical and finite element modeling of deformation during working, and metallurgical aspects of forming processes and resulting products.
Credits: 2.0
Lec-Rec-Lab: (2-0-0)
Semesters Offered: On Demand
Pre-Requisite(s): MY 3400 or MEEM 2150

MY 4600 - Introduction to Polymer Engineering
Basics in polymer science including molecular characteristics, synthesis, structure and properties of polymers. Various processing techniques and mechanical/structural applications of polymers.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: On Demand
Pre-Requisite(s): MY 2100
MY 4710 - Photonic and Micromechanical Materials and Devices
The use of materials science and engineering principles in the design and processing of electronic materials and devices. Topics include operating principles of solid-state electronic devices, electronic materials structure-processing-properties relationships, and materials issues in electronic device fabrication and performance.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring

MY 4740 - Hydrometallurgy/Pyrometallurgy
Extracting metal from ores by aqueous chemical techniques. The unit processes and unit operations in the dissolution, solubility, aqueous chemistry, concentrating and purifying metal-bearing solutions, and recovery of metals by precipitation and electrolytic processing will be discussed.
Credits: 4.0
Lec-Rec-Lab: (4-0-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2007-2008 academic year
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): CH 1120

MY 4800 - Material and Process Selection in Design
The principles of materials selection for engineering design. Topics include selection based on strength, stiffness, thermal properties, high temperature behavior, corrosion resistance, formability, joinability, manufacturability, recyclability, etc. Considers ethics and economics. Presents numerous case studies and examples.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Pre-Requisite(s): MY 2100

MY 4900 - Materials Science and Engineering Professional Development
Engineering ethics, professional registration, industrial safety and hygiene, intellectual property, professional development and communication skills in the context of Capstone Senior Design and professional employment.
Credits: 1.0
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior
Pre-Requisite(s): MY 3110 and MY 3210 and MY 3300 and MY 3400

MY 4901 - Materials Science and Engineering Senior Design Project I
Conducted in teams of students working with an industrial partner. Open to all engineering majors interested in interdisciplinary senior design projects. Non-MSE majors must be senior project ready as defined by their major program and obtain permission of the MSE department.
Credits: 2.0
Lec-Rec-Lab: (0-0-6)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior
Pre-Requisite(s): MY 4900

MY 4910 - Materials Science and Engineering Senior Design Project II
Capstone senior design project, conducted in teams of students working on a problem with an industrial partner. Open to all engineering majors interested in interdisciplinary projects. (Senior project ready as defined by major substitutes for prerequisites.)
Credits: 3.0
Lec-Rec-Lab: (0-1-6)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior
Pre-Requisite(s): MY 4901

MY 4970 - Special Topics - Materials
Special topics in materials science and engineering.
Credits: variable to 4.0; May be repeated
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of instructor required

MY 4990 - Undergraduate Research
Undergraduate research in materials science and engineering. Independent research conducted under the guidance of a faculty member.
Credits: variable to 6.0; May be repeated
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of instructor required

Physical Education
PE 0101 - Flag Football
Fundamental skills, rules, and play of flag football. May be used once as a general education co-curricular course. Offered the first half of fall semester.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall

PE 0102 - Orienteering
"Hands on" course teaches basic principles of orienteering including map reading emphasizing terrain association/elevation, map margin information, topographic symbology, and determining location using intersection and resection techniques. May be used once as a general education co-curricular course. Offered first half and last half of fall semester.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Summer

PE 0103 - Bait and Fly Casting
Bait and fly casting skills. Each student must have a suitable pole, reel, lures, and line as well as a valid current year Michigan fishing license. Requires three Sunday classes. May be used once as a general education co-curricular course. Offered the first half of fall semester and the first half and last half of summer semester.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Summer

PE 0104 - Ultimate Frisbee
Fundamental skills, rules, and play of ultimate frisbee. The class is physically strenuous. Personal frisbee is recommended. May be used once as a general education co-curricular course. Offered the first half of fall semester and the last half of summer.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Summer

PE 0105 - Beginning Bowling
Fundamental skills, rules, and scoring of bowling. May be used once as a general education co-curricular course. Offered the first and second half of fall and spring semesters.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring

PE 0106 - Beginning Golf
Rules, terminology, and etiquette of golf and the individual skills of grip, stance, and swing. Equipment is supplied. May be used once as a general education co-curricular course. Offered the first half of fall semester, the second half of spring semester, and the first half of summer.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring, Summer

PE 0107 - Floor Hockey
Individual skills, team techniques, rules and strategies of floor hockey. Hockey gloves or winter gloves are highly recommended. Sticks and goalie equipment are provided. May be used once as a general education co-curricular course. Offered the last half of fall semester and the first and second half of spring semester.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring

PE 0108 - Broomball
Students will learn the rules, strategy, and safety needed to compete in broomball. Offensive and defensive zone coverages and individual skills are stressed. Team play with officials. May be used once as a general education co-curricular course. Offered the first half of spring semester.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring

PE 0109 - Aikido
Aikido is a specific martial arts training for physical and character development. Physically strenuous. Students should wear loose sweatsuits (with long sleeves) or white martial arts uniform. 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 0110 - 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 in addition to releasing 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

PE 0113 - Disc Golf
Fundamental skills, rules and play of disc golf. Students will learn recreational play and organized tournament play (various formats). Students must have their own disc (or discs). The class meets at MTU's Disc Golf Course on Sharon Avenue by the Advanced Technology Development Complex. 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 0115 - Beginning Swimming
Nonswimmers learn to have no fear of water, to float, and to swim the four fundamental strokes. May be used once as a general education co-curricular course. Offered the last half of fall semester, the first half of spring semester, and one track of summer.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring, Summer

PE 0116 - Beginning Basketball
Theory, organization, and defensive and offensive skills of basketball. May be used once as a general education co-curricular course. Offered the first half of fall and spring semesters.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring

PE 0117 - Beginning Hockey
Individual skills, team techniques, rules, and strategies. Requires basic 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. Offered the first and second half of fall semester and the first half of spring semester.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring

PE 0118 - Beginning Weight Training
Training methods for physical development using stationary and free weights. May be used once as a general education co-curricular course. Offered the first half and the last half of fall and spring semesters, and the first half of the summer semester.
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. Requires season pass for Mont Ripley. 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. Offered the first half of spring semester.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Spring

PE 0121 - Beginning Snowboarding
Beginning skills of snowboarding techniques taught, evaluated, and recommendations made for improvement. Requires season pass for Mont Ripley. 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. Offered the first half of spring semester.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, 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. Offered the first half of fall semester and the first and second half of summer semester.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Summer

PE 0125 - Sand Volleyball
Sand volleyball history, philosophy, and rules. Passing, setting, attacking, serving, blocking, round robin, 2 vs. 2, and 4 vs. 4 tournaments, 6 vs. 6 system and drills to improve one's overall play. May be used once as a general education co-curricular course. Offered first half of fall semester and summer.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Summer

PE 0126 - Beginning Volleyball
Fundamentals, rules interpretation, strategy, and conduct of tournament play. May be used once as a general education co-curricular course. Offered the first half of fall semester and the first half of spring semester.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring

PE 0127 - Beginning Archery
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 on campus). May be used once as a general education co-curricular course. Offered the first half and the last half of fall and spring semesters.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring

PE 0130 - Water Aerobics
Improvement of fitness and body measurement through diet and water exercise. May be used once as a general education co-curricular course. Offered the first half of fall semester and the last half of spring semester.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring

PE 0132 - Beginning Soccer
Fundamental skills, techniques, terminology, and rules of soccer. May be used once as a general education co-curricular course. Offered the first half of fall semester.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring

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. Offered the first half of spring semester.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Spring

PE 0136 - 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. Offered the first half of fall and spring semesters.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring

PE 0139 - Beginning Badminton
Fundamental skills, rules, and scoring of badminton. May be used once as a general education co-curricular course. Offered the first half of fall and spring semesters.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring

PE 0140 - Beginning Tennis
Fundamentals of the game, rules, and etiquette of tennis. Meets at Gates Tennis Center. Tennis balls and racquets provided. Recommend use of personal racquet. May be used once as a general education co-curricular course. Offered the first half and last half of fall and spring semesters, and the first half of summer semester.
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. Offered the first half and last half of fall and spring semesters.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring
PE 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. Offered the first half and last half of fall and spring semesters.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring

PE 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. Offered the first half and last half of fall semester and the first half of spring semester.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring

PE 0150 - Lifetime Activities
This class will introduce students to a variety of recreational activities often used in a social/leisure setting (i.e. shuffleboard). May be used once as a general education co-curricular course. Offered the first half and last half of fall, spring and summer semesters.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring, Summer

PE 0152 - Beginning Social Dance
Introduction to a variety of dance steps, such as the jitterbug/swing, polka, country 2 step, tango, waltz, fox trot, and slow dance. May be used once as a general education co-curricular course. Offered the first half and last half of fall semester, and the first half of spring semester.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring, Summer

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. Offered the first half and last half of fall and spring semesters.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring

PE 0155 - Beginning Road Biking
Learn to be comfortable and confident while riding a regular road bike. Covers basic maintenance repair procedures. Requires own equipment and supplies, including a bike helmet. May be used once as a general education co-curricular course. Offered the first half of fall semester.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall

PE 0156 - Beginning Mountain Biking
Learn to be comfortable and confident while riding a mountain bike off-road. Covers basic maintenance repair procedures. Requires own equipment and supplies as well as a biking helmet. May be used once as a general education co-curricular course. Offered the first half of fall and summer semesters.
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. Offered the first half of fall and summer semesters.
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. Offered the first half of fall and summer semesters.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Summer

PE 0166 - Moving for Fitness
Running, walking, rollerblading, and biking. Basic movement at your own level. Requires own equipment for all activities. May be used once as a general education co-curricular course. Offered the first half of fall and spring semesters.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring

PE 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. Offered the first half of fall and spring semesters.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring, Summer

PE 0173 - Fall Outdoor Adventures
Outdoor seasonal activities to include hiking, camping, fishing, orienteering, etc. May be used once as a general education co-curricular course. Offered the first half of fall semester.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall

PE 0174 - Winter Outdoor Adventures
Outdoor seasonal activities to include fishing, camping, skiing, orienteering, etc. May be used once as a general education co-curricular course. Offered the first half of spring semester.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Spring

PE 0175 - Hiking
Fundamental knowledge and skills specific to hiking will be covered. Good hiking boots & backpack are required, compass is recommended. Course may meet on some weekends. May be used once as a general education co-curricular course. Offered the first half and last half of summer semester.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Summer

PE 0205 - Intermediate Bowling
Intermediate to advanced techniques in bowling, including skills and strategy involved in tournament play. May be used once as a general education co-curricular course. Offered the first half and last half of fall and spring semesters.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring

PE 0206 - Intermediate Golf
Intermediate to advanced individual instruction in golf techniques, terms, courtesies, and tournament regulations. Equipment needed; some rental clubs available. Requires purchase of golf pass. May be used once as a general education co-curricular course. Offered the first half of fall semester and the first half and last half of summer semester.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Summer

PE 0210 - Special Topics in Physical Education
Unconventional activity courses that address varying and 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. Offered the last half of fall semester, the first half of spring semester, and once during summer semester.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, 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. Offered the last half of fall and spring semesters.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring

PE 0217 - Intermediate Hockey
Intermediate/advanced techniques, skills, and strategies. 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. Offered the last half of fall and the first half of spring semester.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring

PE 0218 - Intermediate Weight Training
Intermediate to advanced techniques of weight lifting. May be used once as a general education co-curricular course. Offered the last half of fall, spring and summer semesters.
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. Requires season pass to Mont Ripley. 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. Offered the first half of spring semester.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Spring

Undergraduate Course Descriptions, 2007-08, Page 69 of 86
PE 0221 - Intermediate Snowboarding
Intermediate to advanced skills of snowboarding techniques taught, evaluated, and recommendations made for improvement. Requires season pass to Mont Ripley. 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. Offered the first half of spring semester.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Spring

PE 0222 - Alpine Ski Racing
Intermediate to advanced skills of alpine ski racing techniques taught. Ski races each week, alternating between giant slalom, slalom, and super-G. Requires season pass for Mont Ripley. 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. Offered the first half of spring semester.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Spring

PE 0223 - Freestyle (jumps/tricks) Alpine Skiing
Fundamentals of freestyle (jumps/tricks) skiing techniques taught, evaluated, and recommendations made for improvement. Requires season pass for Mont Ripley. 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. Offered the first half of spring semester.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Spring

PE 0224 - Snowboard Racing (Bordercross)
Intermediate to advanced skills of bordercross snowboard racing techniques taught. Weekly bordercross racing. Requires season pass for Mont Ripley. 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. Offered the first half of spring semester.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Spring

PE 0225 - Freestyle (jumps/tricks) Snowboarding
Fundamentals of freestyle (jumps/tricks) snowboarding techniques taught, evaluated, and recommendations made for improvement. Requires season pass for Mont Ripley. 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. Offered the first half of spring semester.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Spring

PE 0226 - Intermediate Volleyball
Organization and development of team competition in volleyball. Requires previous volleyball experience. May be used once as a general education co-curricular course. Offered the first half of fall semester, and the first half and last half of spring semester.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring

PE 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. Offered the first half and last half of fall and spring semester.
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. Offered the first half of spring semester.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall

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. Offered the first half of fall semester.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall

PE 0233 - 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. Offered the first half of spring semester.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Spring

PE 0238 - Intermediate Racquetball/Squash
Reviews the fundamentals and instructs the students on the intermediate/advanced skills of racquetball and squash. Gives all students the opportunity to play singles, cutthroat, and doubles. Racquets, balls, and eyewear provided. Recommend use of personal racquet. May be used once as a general education co-curricular course. Offered the last half of fall and spring semesters.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring

PE 0239 - Intermediate Badminton
Intermediate to advanced techniques, skills, and strategies involved in badminton. May be used once as a general education co-curricular course. Offered the last half of fall semester.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall

PE 0240 - Intermediate Tennis
Intermediate to advanced techniques, skills, and strategies in tennis. Class meets at Gates Tennis Center. Tennis balls and racquets provided. Recommend use of personal racquet. May be used once as a general education co-curricular course. Offered the first half and last half of fall and spring semesters and the last half of summer semester.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring

PE 0246 - Intermediate Billiards
Intermediate to advanced techniques, skills, and strategies in billiards. May be used once as a general education co-curricular course. Offered the first half and last half of fall and spring semesters.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring

PE 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. Offered the last half of fall semester and the first half of spring semester.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall

PE 0252 - Intermediate Social Dance
Continuation of beginning social dance. May be used once as a general education co-curricular course. Offered the last half of spring semester.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Spring

PE 0253 - Intermediate Aerobics
Intermediate to advanced techniques and steps involved in aerobics. Requires previous aerobics experience. May be used once as a general education co-curricular course. Offered the last half of fall semester and the first half and last half of spring semester.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall

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. Offered the first half of fall and the second half of summer semester.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Summer
PE 0266 - Running for Fitness
The techniques, skills, and strategies involved in running. The class is physically strenuous. Requires appropriate running shoes and attire. May be used once as a general education co-curricular course. Offered the first half of fall semester and the first half and last half of summer semester.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Summer

PE 0270 - Intermediate Tae Kwon Do and Hapkido
Intermediate to advanced techniques, skills, and strategies involved in TaeKwonDo. May be used once as a general education co-curricular course. Offered the last half of fall and spring semesters.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring

PE 0301 - Military Marksmanship
Develops marksmanship skills through individual practice and competition among individuals and record fire for qualification. Emphasizes awareness of firearm safety and leadership responsibility through marksmanship training. May be used once as a general education co-curricular course.
Credits: 1.0; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring

PE 0306 - Advanced Golf
Learn different types of tournaments. Compete with advanced players and learn proper etiquette in tournament competition. Add to skills in this great lifelong sport. May be used once as a general education co-curricular course. Offered first half of fall semester.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall

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. Offered the first half of fall semester.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall

PE 0320 - Advanced Skiing
Advanced skills of skiing techniques taught, evaluated, and recommendations made for improvement. Requires season pass for Mont Ripley. 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. Offered the first half of spring semester.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Spring

PE 0321 - Advanced Snowboarding
Advanced skills of snowboarding techniques taught, evaluated, and recommendations made for improvement. Requires season pass for Mont Ripley. 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. Offered the first half of spring semester.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Spring

PE 0340 - Advanced Tennis
Advanced skills and strategy to make play more efficient. Multiple spins on forehand and backhand, ground strokes, drop shots, and different types of serves. May be used once as a general education co-curricular course. Offered the last half of spring semester.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Spring

PE 0355 - Advanced Road Biking
Learn advanced road biking techniques and strategies. Course requires own equipment, including road bike/wheels, bike shorts, biking shoes/pedals, and a helmet. Course also requires sufficient fitness to ride continuously in excess of 15 mph for 1.5 hours. May be used once as a general education co-curricular course. Offered the first half of fall semester.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall
Restrictions: Permission of department required
PE 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; May be repeated; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-5)
Semesters Offered: Fall

PE 2150 - Cross Training
A broad base understanding of sports cross training and activities that can be pursued as lifelong activities. May be used once as a general education co-curricular course.
Credits: 1.0; May be repeated; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-5)
Semesters Offered: Fall, Spring

PE 2230 - Cheerleading Dance Team
A dance squad that attends set class practices and participates in athletic contests. A varsity letter is earned by those who fulfill the requirements. May count once for co-curricular general education credit.
Credits: 1.0; May be repeated; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-5)
Semesters Offered: Fall, Spring

PE 2240 - Cheer Team
A squad that attends set class practices and participates in athletic contests. A varsity letter is earned by those who fulfill the requirements. May be used once as a general education co-curricular course.
Credits: 1.0; May be repeated; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-5)
Semesters Offered: Fall, Spring

Physics
PH 0010 - Development of Physics Skills
Individualized instruction in physics problem solving and general study skills from professional physics coaches. Benefits students looking for help with demanding introductory physics courses (PH1110, PH1210, PH2100, PH2200). Credits do not count toward graduation.
Credits: 0.0; May be repeated
Semesters Offered: Fall, Spring
Restrictions: Permission of instructor required

PH 0020 - Team Approach to Learning Physics
Students meet 2 hours/week with 4 to 6 team members taking the same introductory physics course. Students work with a professional physics coach to learn the team approach to physics problem solving. Benefits students looking for help with demanding courses who desire experience in team problem solving. Credits do not count toward graduation.
Credits: 0.0; May be repeated
Semesters Offered: Fall, Spring
Restrictions: Permission of instructor required

PH 1090 - The Physics Behind Music
Physics concepts and methods associated with musical instruments, musical recording, and musical acoustics are discussed at an introductory level. Topics include periodic motion, normal modes and resonance, superposition and Fourier series, waves, sound and acoustics, magnetism and electromagnetic induction, and topics from non-linear physics.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Pre-Requisite(s): MA 1032 or MA 1031 or MA 1135(C) or MA 1140(C) or MA 1160(C) and (0-0-5)

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

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): Applied Physics, Physics
Pre-Requisite(s): MA 1032 or MA 1031 or MA 1135(C) or MA 1140(C) or MA 1160(C) or MA 1161(C)

PH 1111 - College Physics I Laboratory
Experiments covering kinematics, forces, conservation of momentum and energy, waves, and thermodynamics are explored through guided construction. The course provides inquiry-based laboratory experiences for concepts explored in PH1110.
Credits: 1.0
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring, Summer
Restrictions: May not be enrolled in one of the following College(s): School of Technology, College of Engineering; May not be enrolled in one of the following Major(s): Applied Physics, Physics
Pre-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 College(s): School of Technology
Pre-Requisite(s): MA 1031 or MA 1032 or MA 1140(C) 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 College(s): School of Technology
Pre-Requisite(s): PH 1141

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): Applied Physics, Physics
Pre-Requisite(s): PH 1161(C) and (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): Applied Physics, Physics

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 PH1141 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: 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): Applied Physics, 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
Co-Requisite(s): PH 1200
Pre-Requisite(s): PH 1140

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
Pre-Requisite(s): PH 1361
Co-Requisite(s): (PH 1160 or PH 2100) and MA 2160(C)

PH 1361 - Introductory Experimental Physics II
Laboratory complement to PH 1360. Waves, thermodynamics, and electrostatics are explored through guided construction. The course emphasizes understanding physical concepts through inquiry and the scientific method.
Credits: 1.0
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Spring
Pre-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
Pre-Requisite(s): PH 1600

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
Pre-Requisite(s): PH 1610

PH 2010 - Sophomore Seminar
Discussion of recent research and developments in physics.
Credits: 1.0
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman

PH 2100 - University Physics I-Mechanics
A calculus-based introduction to classical mechanics. Topics include kinematics, Newton's laws, impulse and momentum, work and energy, and the universal law of gravitation.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring, Summer
Pre-Requisite(s): PH 1100(C) and (MA 1160 or MA 1161) and 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, electromagnetic waves and geometrical optics.
Credits: 3.0
Lec-Rec-Lab: (2-0-3)
Semesters Offered: Fall
Pre-Requisite(s): (PH 1200(C) or PH 2261(C)) and (PH 2100 or PH 1160) and MA 2160

PH 2230 - Electronics for Scientists
An introduction to analog and digital electronics with an emphasis on their use in the laboratory. Topics include linear devices and basic linear circuit analysis; diodes; transistors; op-amps; the use of digital components, including logic gates, flip-flops, counters, clocks and microcontrollers, and analog to digital conversions.
Credits: 4.0
Lec-Rec-Lab: (3-0-3)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Major(s): Computer Engineering, Electrical Engineering
Pre-Requisite(s): PH 2200 or PH 2260

PH 2260 - Honors Physics III - Electricity and Magnetism
Calculus-based introduction to electromagnetism. Topics include Coulomb's law, electric fields, Gauss's law, electric potential, capacitance, circuits, magnetic forces and fields, Ampere's law, induction, Maxwell's equations, electromagnetic waves and geometrical optics.
Credits: 4.0
Lec-Rec-Lab: (4-0-0)
Semesters Offered: Fall
Pre-Requisite(s): (PH 1160 or PH 2100) and (PH 1200(C) or PH 2261(C)) and MA 2160

PH 2261 - Introduction to Experimental Physics III
A laboratory complement to PH2260. Experiments covering Coulomb's law, electric and magnetic fields, circuits, induction, geometrical optics, and modern physics are explored through guided construction. The course emphasizes understanding physical concepts through inquiry and the scientific method.
Credits: 1.0
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall
Pre-Requisite(s): PH 1100 or PH 1161

PH 2300 - University Physics III-Fluids and Thermodynamics
A calculus-based introduction to fluids and thermal physics. Topics include fluid motion, propagation of heat and sound, temperature and the kinetic theory of gases, heat capacity and latent heat, first law of thermodynamics, heat engines and the second law, entropy, and an introduction to statistical mechanics. Offered second half of spring semester.
Credits: 2.0
Lec-Rec-Lab: (4-0-0)
Semesters Offered: Spring
Pre-Requisite(s): PH 1100 or PH 2100

PH 2400 - University Physics IV-Waves and Modern Physics
A calculus-based introduction to waves and modern physics. Topics include interference and diffraction, special relativity, photons and matter waves, the Bohr atom, wave mechanics, atomic physics, molecular and solid-state physics, and nuclear physics.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring - Offered every third year beginning with the 2008-2009 academic year
Pre-Requisite(s): PH 2200 or PH 2260

PH 3110 - Theoretical Mechanics I
An intermediate study of mechanics, including the study of relativistic mechanics, kinematics, Newtonian mechanics of a single particle, oscillations, motion in noninertial reference frames, and gravitation and central-force motion.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall

PH 3111 - Theoretical Mechanics II
A continuation of PH3110. Includes the study of the dynamics of a system of particles, rigid body motion, Lagrangian and Hamiltonian mechanics, coupled oscillations, and continuous systems.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall

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 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

Undergraduate Course Descriptions, 2007-08, Page 73 of 86
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 3530

PH 3410 - Quantum Physics I
An introduction to the foundations of modern physics and Schrodinger's wave mechanics. Topics include thermal radiation, particle-like properties of radiation, Bohr's model of the atom, matter waves, Schrodinger's wave mechanics, quantization of angular momentum, and the one-electron atom.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Pre-Requisite(s): PH 2400 and (MA 3520 or MA 3521 or MA 3530 or MA 3560)

PH 3411 - Quantum Physics II
A continuation of PH3410. Includes the study of spin and magnetic interactions, multi-electron atoms, quantum statistics, molecules, solids, and elementary particles.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Pre-Requisite(s): PH 3410

PH 3480 - Modern Physics Laboratory
Advanced laboratory techniques emphasized in a series of experiments in modern physics.
Credits: 2.0
Lec-Rec-Lab: (0-0-6)
Semesters Offered: Spring
Pre-Requisite(s): PH 2230

PH 4010 - Senior Physics Colloquium I
Class discussion of the literature in the field of physics. Requires oral and written presentations.
Credits: 1.0
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior
Co-Requisite(s): PH 4080

PH 4011 - Senior Physics Colloquium II
A continuation of PH4011. Class discussion of current literature and recent advances in physics. Requires oral and written presentations.
Credits: 1.0
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior
Co-Requisite(s): PH 4081
Pre-Requisite(s): PH 4010

PH 4050 - Qualitative Methods in Physics
General methods and approaches of the physicist, including modeling, scaling, numerical estimation, and dimensional analysis as applied to the development, understanding, and solution of physics problems.
Credits: 1.0
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Major(s): Applied Physics, Physics; May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior
Co-Requisite(s): PH 4010
Pre-Requisite(s): PH 3480

PH 4080 - Senior Research I
Introduction to research under the guidance of a faculty member. In addition, creative problem solving will be assessed via a student-initiated project.
Credits: 3.0
Lec-Rec-Lab: (0-0-6)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior
Co-Requisite(s): PH 4010
Pre-Requisite(s): PH 3480

PH 4081 - Senior Research II
Continuation of research under the guidance of a faculty member, culminating in a written report and presentation of results at an undergraduate research forum.
Credits: 3.0
Lec-Rec-Lab: (0-0-6)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior
Co-Requisite(s): PH 4011
Pre-Requisite(s): PH 4080

PH 4090 - Senior Thesis
Students prepare an in-depth written thesis on an approved topic in physics. Normally taken the last semester before graduation in conjunction with PH4081.
Credits: 1.0
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Spring
Restrictions: Permission of instructor required; May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior

PH 4210 - Electricity and Magnetism I
Intermediate study of the basic theory of electricity and magnetism, including a detailed study of electrostatic field theory and an introduction to magnetostatics.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Pre-Requisite(s): (PH 2200 or PH 2260) and PH 3110 and (MA 3520 or MA 3521 or MA 3530 or MA 3560)

PH 4211 - Electricity and Magnetism II
A continuation of PH4210. Intermediate study of magnetostatics, electrodynamics, and electromagnetic waves.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Pre-Requisite(s): PH 4210

PH 4380 - Computers in the Physics Lab
How computers are used for data acquisition, data treatment and analysis, graphics display, and controlling experiments. Develops skills necessary to interface and automate instruments and systems.
Credits: 2.0
Lec-Rec-Lab: (0-0-5)
Semesters Offered: Fall
Pre-Requisite(s): PH 2230

PH 4390 - Computational Methods in Physics
An overview of numerical and computer methods to analyze and visualize physics problems in mechanics, electromagnetism, and quantum mechanics. Utility and potential pitfalls of these methods, basic concepts of programming, UNIX computing environment, system libraries and computer graphics are included.
Credits: 2.0
Lec-Rec-Lab: (2-0-0)
Semesters Offered: Fall
Pre-Requisite(s): PH 3410

PH 4395 - Computer Simulation in Physics
How computers are used for data acquisition, data treatment and analysis, graphics display, and controlling experiments. Develops skills necessary to interface and automate instruments and systems.
Credits: 2.0
Lec-Rec-Lab: (1-0-4)
Semesters Offered: Spring
Pre-Requisite(s): PH 3300 or PH 5310 and PH 4390 and (PH 2400 or PH 3410)

PH 4430 - Introduction to Nuclear Physics
Ground state properties of stable nuclei of atoms; modes of disintegration of unstable nuclei; elementary theories of alpha, beta, and gamma decay; and nuclear reactions, including fission and fusion.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Pre-Requisite(s): PH 3410 or CH 3520

PH 4510 - Introduction to Solid State Physics
Crystal structures, X-ray diffraction, phonons, free electron theory of metals, rudiments of band theory, an overview of semiconductors, and other topics in solid-state physics.
Credits: 2.0
Lec-Rec-Lab: (2-0-0)
Semesters Offered: Fall
Pre-Requisite(s): (PH 2300 or PH 1360) and PH 2400 and CH 1110 and (MA 3520 or MA 3521 or MA 3530 or MA 3560)

PH 4610 - Stellar Astrophysics
Topics include an overview of observational astrophysics, stellar atmospheres, stellar structure, atomic properties of matter, radiation and energy transport in stellar interiors, and stellar evolution to and from the main sequence.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring - Offered every third year 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 4620 - Galactic Astrophysics
Topics include the composition and dynamics of our galaxy, dynamics of stellar encounters, spiral density wave theory, clusters of galaxies, theoretical cosmology, physics of the early universe, and observational cosmology.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring - Offered every third year 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.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall - Offered alternate years beginning with the 2002-2003 academic year
Pre-Requisite(s): PH 2200 or PH 2260 and (PH 1360 or PH 2300) and (MA 3150 or MA 3160) and (MA 3520 or MA 3521 or MA 3530 or MA 3560)

PH 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 2002-2003 academic year
Pre-Requisite(s): (PH 2200 or PH 2260) and (PH 1360 or PH 2300) and (MA 3150 or MA 3160) and (MA 3520 or MA 3521 or MA 3530 or MA 3560)

PH 4999 - Special Topics in Physics
Selected additional topics in physics for advanced students based on interests of faculty and students. Interested students should contact the physics department.
Credits: variable to 9.0; May be repeated
Semesters Offered: Fall, Spring, Summer

Psychology

PSY 2000 - Principles of Psychology
Introduction to the scientific study of psychological structures and processes involved in individual and group behavior. Explores theoretical accounts of the foundations of human behavior and examines empirical support. Topics may include personality, disorders, therapy, development, and social psychology, perception, learning, cognition, emotion, and states of consciousness.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring, Summer

PSY 2100 - Counseling Psychology
Major approaches used in contemporary counseling psychology, the current status of the profession, and ethical issues encountered will be examined to provide students with a broad understanding of the field. This course does not train students to be counselors.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2004-2005 academic year
Pre-Requisite(s): PSY 2000

PSY 2200 - Behavior Modification
An introduction to techniques of behavior modification through the application of learning theories such as classical and operant conditioning. Students will conduct a case study project designed to modify a personal behavior.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall - Offered alternate years beginning with the 2004-2005 academic year
Pre-Requisite(s): PSY 2000

PSY 2501 - Intro to the Psychology Major: Tools and Technology
Psychology majors examine the field of psychology and major degree requirements resulting in an undergraduate plan of study focused on graduate school admission or career preparation. An introduction to the technological tools used within psychology, including hardware, software, and instrumentation.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Major(s): Psychology
Pre-Requisite(s): PSY 2000(C)

PSY 2720 - Statistics for the Social and Behavioral Sciences
An understanding of statistical concepts and ability to conduct statistical analyses (using both hand calculation and SPSS) as used in Social and Behavioral Sciences research. Topics include descriptive statistics, correlation, and inferential statistics through ANOVA.
Credits: 4.0
Lec-Rec-Lab: (0-4-0)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Major(s): Psychology, Social Sciences, Liberal Arts with History Opt
Pre-Requisite(s): MA 1020 or MA 1031 or MA 1032

PSY 3000 - Experimental Methods & Stats
Introduction to experimental design, general research methodology, and the computer analysis and interpretation of data. Emphasizes issues and methods involved in psychological research. Topics include experimental design and validity, choosing appropriate data analysis techniques, and statistical analysis using SPSS.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): PSY 2000 and (MA 2720 or PSY 2720)

PSY 3001 - Experimental Methods and Statistics II
Second course in psychological research methodology and statistics, both experimental and non-experimental. Students design, execute, interpret, and report psychological research.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Major(s): Psychology
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: Fall, Summer
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): PSY 2000 and (UN 1002 or UN 1003)

PSY 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 Sociocultural 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

PSY 3040 - History/Systems of Psychology
Traces major historical contributions to current psychology from ancient to modern times. Examines significant ideas and discoveries from philosophy, mathematics, and the natural and medical sciences as they relate to the development of psychology. Discusses philosophical, theoretical, and methodological controversies that surfaced as part of these historical developments.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)

PSY 3050 - Developmental Psychology
A survey of human development across the life span (prenatal, infant, child, adolescent, and adult) in the areas of biological, cognitive, social, emotional, and personality development. Provides students with insight into both the universality of human development and the uniqueness of individuals.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): PSY 2000 and (UN 1002 or UN 1003)

PSY 3060 - Physiological Psychology
Technological advances in the field of psychophysiology will serve as the foundation for understanding the application of psychophysiology in areas such as psychopathology, clinical health psychology, the detection of deception, human factors psychology, and environmental design.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): PSY 2000 and UN 2002 and (BL 1020 or BL 1040 or BL 2010 or BL 2400)
PSY 3070 - Cross-Cultural Psychology
Introduces the student to cross cultural psychology and sociocultural theory as it is applied to psychology. Examines research on cultural specific and universal behaviors. Emphasizes the benefits and challenges of diversity in organizations and diversity skills that promote interpersonal and organizational success.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Pre-Requisite(s): PSY 2000 and (UN 1002 or UN 1003)

PSY 3090 - Directed Research: Undergraduate Research Assistant in Psychology
Directed research in the field of Psychology through the application of research techniques.
Credits: variable to 3.0; May be repeated
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of instructor required; Must be enrolled in one of the following Major(s): Psychology; May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): PSY 2000

PSY 3095 - Teaching Assistant
Undergraduate Teaching Assistant for Principles of Psychology or other Psych course, including tutoring, assessment, test construction.
Credits: variable to 3.0; May be repeated
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of instructor required; Must be enrolled in one of the following Major(s): Psychology
Pre-Requisite(s): PSY 2000

PSY 3160 - Behavioral Neuroscience
A survey of the field of behavioral neuroscience (understanding how the brain controls behavior, perception, and thought). The course will cover the basic structure of the nervous system, research techniques, the motor and sensory systems and complex motivated behaviors such as sleep, reproduction, and eating.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Pre-Requisite(s): PSY 2000 and (BL 1020 or BL 1040 or BL 2010 or BL 2400)

PSY 3200 - Motivation and Emotion
Introduction to the theoretical, physiological, cognitive, and behavioral factors underlying the processes of motivated behaviors and emotional states. Emphasis is placed on methods for studying motivation and emotion and their role in human behavior.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): PSY 2000

PSY 3260 - Sensation and Perception
The structure and function of human and non-human sensory and perceptual systems will serve as the basis for examination of the applications of perception research to areas such as virtual reality, human factors engineering, robotics and sports skills training.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): PSY 2000

PSY 3400 - Cognitive Psychology
A systematic survey of classical and contemporary research topics in human information processing and learning. Topics include models of cognition, perception/pattern recognition, attention, the nature of mental representation and processing; the architecture of memory, imagery, concepts, and prototypes; reasoning, decision making, problem solving, and cognitive development.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): PSY 2000 and (UN 1002 or UN 1003)

PSY 4020 - Industrial Organizational Psychology
The psychology of work and organizations. Introduction to the use and application of psychology in the workplace. Focus is on the development of employees and organizational structure, and social behavior including the management of work groups and organizations.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall - Offered alternate years beginning with the 2006-2007 academic year
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): PSY 2000 and UN 2002(C)

PSY 4050 - Psychology of Science and Technology
Applies experimental and cognitive psychology to the endeavors of science, invention, and innovation. This examination of discovery and invention will provide students with an understanding of the application of psychological science to fields such as Business, Engineering, Computer Science, Law and Medicine. Emphasis will be placed on the bridges psychological findings provide to non-psychology fields.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Pre-Requisite(s): PSY 2000 and UN 2002

PSY 4080 - Topics in Psychology
An examination of a specific area or approach within the field of Psychology.
Credits: variable to 4.0; May be repeated
Semesters Offered: On Demand
Pre-Requisite(s): PSY 2000 and UN 2002

PSY 4090 - Independent Study in Psychology
Designed to allow students to participate in independent readings and research in a variety of areas within psychology. May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): PSY 2000 and PSY 4000(C)

PSY 4095 - Field Experience in Psychology
First-hand 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 9
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of instructor required; Must be enrolled in one of the following Major(s): Psychology; May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): PSY 2000 and PSY 2500

PSY 4100 - 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: On Demand
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): PSY 2000 and UN 2002(C)

PSY 4110 - Learning and Memory
Theories of learning and memory from traditional animal research findings, human research, and more recent trends examining the neural basis of learning and memory will be examined to understand changes in behavior, including the acquisition and retention of knowledge.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): PSY 2000

PSY 4120 - Human Factors Psychology
Basic psychological concepts critical to the design of human-technological systems. This class provides an applied perspective of psychological research and insight into the most unpredictable and error-prone component of human-machine systems - the human! Appropriate for both psychology and engineering students.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall - Offered alternate years beginning with the 2007-2008 academic year
Pre-Requisite(s): PSY 2000

PSY 4220 - Psychology and Law
 Applies experimental and cognitive psychology to the endeavors of science, invention, and innovation. This examination of discovery and invention will provide students with an understanding of the application of psychological science to fields such as Business, Engineering, Computer Science, Law and Medicine. Emphasis will be placed on the bridges psychological findings provide to non-psychology fields.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Pre-Requisite(s): PSY 2000 and UN 2002

PSY 4080 - Topics in Psychology
An examination of a specific area or approach within the field of Psychology.
Credits: variable to 4.0; May be repeated
Semesters Offered: On Demand
Pre-Requisite(s): PSY 2000 and UN 2002

PSY 4090 - Independent Study in Psychology
Designed to allow students to participate in independent readings and research in a variety of areas within psychology. May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): PSY 2000 and PSY 4000(C)

PSY 4095 - Field Experience in Psychology
First-hand 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 9
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of instructor required; Must be enrolled in one of the following Major(s): Psychology; May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): PSY 2000 and PSY 2500

PSY 4100 - 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: On Demand
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): PSY 2000 and UN 2002(C)

PSY 4110 - Learning and Memory
Theories of learning and memory from traditional animal research findings, human research, and more recent trends examining the neural basis of learning and memory will be examined to understand changes in behavior, including the acquisition and retention of knowledge.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): PSY 2000

PSY 4120 - Human Factors Psychology
Basic psychological concepts critical to the design of human-technological systems. This class provides an applied perspective of psychological research and insight into the most unpredictable and error-prone component of human-machine systems - the human! Appropriate for both psychology and engineering students.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall - Offered alternate years beginning with the 2007-2008 academic year
Pre-Requisite(s): PSY 2000

PSY 4220 - Psychology and Law
Application of psychological principles to legal concerns and the interaction of psychology and law. Topics include perception, memory, and decision-making processes as applied to eyewitnesses, identification and evaluation of suspects, jury trials, capital punishment, and other current topics.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2005-2006 academic year
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): PSY 2000
PSY 4500 - Senior Seminar: Psychology Capstone
Focusing on career preparation or application to graduate programs, an
intensive exploration into an aspect (e.g., teaching, service, research) and area
(e.g., experimental, developmental, clinical) of psychology will enhance
learning and unify knowledge and experiences acquired as a psychology
major.
Credits: 2.0
Lec-Rec-Lab: (0-2-0)
Semesters Offered: Fall, Spring, Summer
Restrictions: Must be enrolled in one of the following Major(s): Psychology
May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): PSY 4000 and PSY 4001(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

Systems Administration Technology

SAT 1200 - Introduction to Programming
Introductory course in C programming. Topics include top-down analysis of
problems, structured programming, data storage, control statements, loops
and subprograms. Basic concepts of object oriented programming will also be
introduced.
Credits: 3.0
Lec-Rec-Lab: (2-0-2)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Major(s): Computer
Network & System Admin
Pre-Requisite(s): SAT 1200 or SAT 2400

SAT 1610 - Computer and OS Architecture
Fundamentals of computer organization, operating system architecture,
PC/WS major subassemblies, PC and server configuration planning, power
interfaces, system assembly/set-up, connection of peripherals, installing
fundamental operating system software, system testing/debugging and
planning and installation of application software portfolio.
Credits: 3.0
Lec-Rec-Lab: (2-0-2)
Semesters Offered: Fall, Spring
Restrictions: Must be enrolled in one of the following Major(s): Computer
Network & System Admin
Pre-Requisite(s): SAT 1200 or SAT 2400

SAT 1700 - Computer-Cyber Ethics/Policy
Ethical, privacy, liability, and regulatory compliance issues in managing
computer and network administrations. Other topics include the digital ID
debate, biometrics, computer use policy, privacy statements, P3P, security
policy, FCC mandates, state utility commission mandates, W3C, standards
development bodies.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Major(s): Computer
Network & System Admin
Pre-Requisite(s): SAT 1200 or SAT 2400

SAT 2343 - Network Administration I
Introduction to basic networking concepts and implementation. Topics include
OSI model, subnetting and addressing, data encapsulation, network
topologies, administration UNIX and NT systems running TCP/IP, and basic
configuration of networking hardware including cabling, bridges, routers, and
other communications.
Credits: 4.0
Lec-Rec-Lab: (0-3-2)
Semesters Offered: Fall
Pre-Requisite(s): SAT 1610

SAT 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 2600 - Mobile Computing and FCC Regulations
Evolution of the wired and wireless communications industry, industry
standards, and regulations. Key topics include Wi-Fi 802.11x, Bluetooth
802.15.1, Zigbee/G Mesh 802.15.4, Passive RFID tags, cellular GSM, GPRS &
CDMA protocols, and PDA platforms/OS’s (i.e. Palm, MS, Research in Motion,
and Symbian).
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Spring
Pre-Requisite(s): SAT 2343

SAT 2711 - Unix & Linux Administration I
Study of networked systems in a UNIX, Linux and Mac OS X environment.
Topics include system kernel, SSH, utilities, process management,
backup/restore, adding devices, and networking hardware including cabling,
modems, routers, communication devices, ethernet, TCP/IP, and networking
protocols.
Credits: 4.0
Lec-Rec-Lab: (0-3-3)
Semesters Offered: Fall, Summer
Pre-Requisite(s): SAT 1200

SAT 3210 - Database Management
Introductory course on database management. Topics include the essential
concepts, principles, and techniques of modern database systems.
Administration of latest RDBMS, such as MS SQL, Server 2005, and Oracle
10g, will be introduced.
Credits: 3.0
Lec-Rec-Lab: (2-0-2)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Major(s): Computer
Network & System Admin
Pre-Requisite(s): SAT 2511 and SAT 2711

SAT 3343 - Network Administration II
Study of networked routers and switches. Topics include TCP/IP, ICMP, router
passwords, access-lists, remote network structures, network topologies, telnet
and SSH authentication, switch programming, VLAN and STP configuration,
loading IOS flash, IP traffic control, network troubleshooting, and WAP
capsulation.
Credits: 4.0
Lec-Rec-Lab: (0-3-3)
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 server, connecting Macintoshes to Windows, integrating
Network to Windows, MS system tuning, remote access, and back up and
recovery from failures.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Fall
Pre-Requisite(s): SAT 3441 or SAT 2511

SAT 3711 - Unix & Linux Administration II
Advanced study of UNIX and Linux OS. Topics include system management,
installation and maintenance, network security, data integrity, and enterprise
infrastructures such as identity management, authentication, authorization and
directory services.
Credits: 3.0
Lec-Rec-Lab: (2-0-2)
Semesters Offered: Spring, Summer
Pre-Requisite(s): SAT 2711

SAT 3812 - Network Security Engineering I
Planning and managing system security in a TCP/IP converged enterprise
network environment. Topics include security architecture, patch management,
performance monitoring, security management tools, best practices, policy
management, virus scanning, security protocols, intrusion detection, firewalls,
and SSL/TLS.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Fall
Pre-Requisite(s): SAT 2511 and SAT 2711

SAT 4200 - Storage Area Networking
Study of distributed network storage methods, that is iSCSI, DAS, NAS, and
SAN technologies. Other topics include storage and compute virtualization,
configuration management, storage farms, backup and recover.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Fall
Pre-Requisite(s): SAT 2511 and SAT 2711
SAT 4240 - VoIP 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: (2-0-2)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Major(s): Computer Network & System Admn
Pre-Requisite(s): SAT 2511 and SAT 2711 and SAT 3343

SAT 4310 - Scripting Programming
Emphasizes the fundamentals of scripting programming, testing, implementation and documentation (i.e. PERL, PHP 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: (2-0-2)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Major(s): Computer Network & System Admn
Pre-Requisite(s): SAT 2511 and SAT 2711 and SAT 3343

SAT 4343 - Network Engineering
Topics include router and switch flow control; VoIP, compression and load balancing; VPN networks involving MPLS, IPSEC and PPP; advanced access-list configuration; AAA; Kerberos; TACACS; Firewalls; and configuration of routing protocols such as RIP, EIGRP, OSPF, IS-IS and BGP.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Spring
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 Admn; May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): SAT 1200 and SAT 2511 and SAT 2711

SAT 4541 - Windows 2000 Directory Services
Advanced concepts of planning and implementing Microsoft Windows 2000 Active Directory and LDAP directory in an enterprise environment.
Credits: 3.0
Lec-Rec-Lab: (2-0-2)
Semesters Offered: Fall
Pre-Requisite(s): SAT 3511 and SAT 3711

SAT 4600 - Web/App Server Administration
Fundamentals of web and application server administration. Topics include server configuration, load balancing, connecting to the internet, web security and administration, communication media, backing up, fault tolerance, and proxy servers. In depth study of Apache web server and Microsoft's Internet Information Server.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: 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 and MA 3203

SAT 4880 - Senior Project II
Capstone course requiring the application of knowledge gained in lower division courses. Projects are team oriented, require weekly progress reports, and culminate with a final report and oral presentation.
Credits: 2.0
Lec-Rec-Lab: (0-0-4)
Semesters Offered: Fall, Spring, Summer
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Co-Requisite(s): SAT 4999
Pre-Requisite(s): SAT 4480

Social Sciences

SS 1001 - Orientation to the Social Sciences
Introduction to departmental requirements, relevant university resources, careers in social sciences and history, skill expectations, and portfolio development; assessment of current knowledge.
Credits: 1.0
Lec-Rec-Lab: (1-0-0)
Semesters Offered: Fall, Spring
Restrictions: Must be enrolled in one of the following Major(s): Social Sciences, Liberal Arts with History Opt

SS 1002 - Orientation to Legal Careers
An introduction to how one becomes an attorney, what it is like to be an attorney, and the career options available to attorneys.
Credits: 2.0
Lec-Rec-Lab: (2-0-0)
Semesters Offered: Spring

SS 2100 - World Peoples & Environments
Introduction to two major disciplines, anthropology and geography, that focus on human diversity and the human relationship to environment and resources. Emphasizes patterns of culture and nature at different scales of human organization.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, 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

SS 2500 - The American Experience
Covers selected topics related to historical development of American culture and society. Topics include American Revolution, slavery and Civil War, Jacksonian democracy, the West, urbanization and immigration, technology, work, Progressives and expertise, World War I, wealth and leisure, Americans and politics, mass communications and media, and the Great Depression.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring, Summer

SS 2550 - Themes in Western Civilization
Overview of the evolution of Western civilization. Reviews the major themes and movements that have influenced Western civilization, the factors that have contributed to its distinctiveness, and its impact on other civilizations.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall

SS 2600 - American Government & Politics
Outlines the principles and logic of American Government and politics and explores contemporary issues in national and state government.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring, Summer

SS 2610 - Introduction to Law and Society
Examining the civil and criminal justice system to explain how laws informs yet is shaped by political, economic, and social forces. This course covers issues such as individual rights, the jury system, tort law, legal reform movements and constitutional interpretation.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2006-2007 academic year
Pre-Requisite(s): UN 1002(C) or UN 1003(C)

SS 2700 - Introduction to Sociology
Introduces students to the way that sociologists think about different components of society. Topics include the family, religion, markets, organizations, political systems, and educational systems. Also covers the source of individual values, beliefs, and attitudes.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
SS 3100 - Developing Societies
An overview of the developing world. Asks "What is development?" in ecological, human, and economic terms. Explores variation among developing societies and elements of internal differentiation, including cultures, regions, classes, and genders. Emphasizes active student exploration of strategies for change, including technology, business, and political transformations.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2000-2001 academic year
Pre-Requisite(s): UN 1002 or UN 1003

SS 3200 - Historical Archaeology
Introduction to historical archaeology. Topics include the methods of historical archaeology, theoretical approaches, and sources of evidence. Emphasizes archaeological contributions to understanding of the American past, and the contributions of historical archaeology to an alternative view of American history and culture.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Pre-Requisite(s): UN 1002 or UN 1003

SS 3210 - Field Archaeology
Practical experience and training in the methods and techniques of field archaeology. Selected readings are followed by active participation in site survey, testing, excavation, record keeping, and analysis. Students benefit through involvement in ongoing research projects.
Credits: variable to 8.0; Repeatable to a Max of 8
Semesters Offered: Summer
Pre-Requisite(s): UN 1002 or UN 1003

SS 3211 - Ethnographic Methods
Field-based course that surveys basic concepts of ethnography and applies them in a class-based research project. Provides practical experience in field observation, interviews, oral history, field notes, and write-up of research.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2007-2008 academic year
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): UN 2002

SS 3220 - Archaeological Sciences
Introduction to the archaeological sciences, including geo/bioarchaeology and materials science. Lectures emphasize connections between field and laboratory, and scientific and environmental perspectives on the world's peoples and cultures, both ancient and industrial. Students undertake hands-on exploration through course laboratory component.
Credits: 4.0
Lec-Rec-Lab: (3-0-3)
Semesters Offered: Fall - Offered alternate years beginning with the 2006-2007 academic year
Pre-Requisite(s): SS 2200 and (UN 1002 or UN 1003)

SS 3230 - Archaeology of Industry
The study of industrial heritage using archaeological and historical perspectives. Covers theories, methods, and techniques by means of lectures, readings, and case studies. Students conduct original research, generally on Copper Country industrial sites, under the guidance of the instructor.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Pre-Requisite(s): UN 1002 or UN 1003

SS 3240 - Reading the Landscape: Anthropology, Geography, History
Landscape is a lens through which scholars study people, environment, and place. The concept transcends traditional disciplinary boundaries. Students will read and discuss different approaches to landscape, with special focus upon anthropological, geographic, and historical perspectives.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall - Offered alternate years beginning with the 2007-2008 academic year
Pre-Requisite(s): UN 2002

SS 3300 - Environmental Problems
An examination of local, regional, and global contemporary environmental problems. Critical consideration of underlying social, historical, and economic causes. Case studies drawn from topics such as global warming, ozone depletion, groundwater pollution, solid waste disposal, deforestation, and resource depletion. Studies proposed solutions and their impacts.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Pre-Requisite(s): UN 2002

SS 3400 - Contemporary Europe
Examination of the landscapes and cultures of modern Europe. Emphasizes cultural patterns and diversity, environmental quality, economic development, and forces of economic and political unification. Examines urbanization, industry, population, nationalism, and political change through regional examples.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Summer - Offered alternate years beginning with the 2002-2003 academic year
Pre-Requisite(s): UN 1002 or UN 1003

SS 3410 - World Resources & Development
Examination of the human geography and resources of various world regions. Emphasizes factors affecting prospects for development, including population dynamics, natural resource endowment, social and cultural systems, and spatial structure of society. Case studies of individual countries supplement general concepts and theories.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Summer - Offered alternate years beginning with the 2001-2002 academic year
Pre-Requisite(s): UN 2002

SS 3500 - Modern American History
A broad survey of American history from World War II to the present.
Credits: 3.0
Lec-Rec-Lab: (2-0-3)
Semesters Offered: Spring
Pre-Requisite(s): UN 1002 or UN 1003

SS 3505 - Military History of the U.S.
The 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, Spring
Pre-Requisite(s): UN 1002 or UN 1003

SS 3510 - History of American Technology
Survey of the technological changes that transformed a rural, agrarian America into an urban, industrialized nation. Focuses on how America's social values and geographical situation influenced the direction taken by its technology and engineering community and how America's industrialization, in turn, had significant effects on American society.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2006-2007 academic year
Pre-Requisite(s): UN 2002

SS 3511 - History of Science in America
Examines the development of scientific enterprises in the U.S. from the colonial period through the present day. Emphasizes institutional bases of science and the place of scientific activities within American society.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2005-2006 academic year
Pre-Requisite(s): UN 2002

SS 3515 - History of American Architecture
Survey of North American architecture from prehistoric times to the present. Focuses on principal architectural styles, building types, and construction technologies. Also examines ideas about architecture to understand the American past.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Pre-Requisite(s): UN 1002 or UN 1003

SS 3520 - U.S. Environmental History
Examines how human interaction with physical environment has changed in North America over the last four centuries. Topics include uses of land by Native Americans, changes associated with European colonization, incorporation of natural resources into industrial economy, early conservation and preservation movements, and environmental concerns accompanying urbanization and industrialization.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2000-2001 academic year
Pre-Requisite(s): UN 2002

SS 3530 - The Automobile in America
Examines the automobile in diverse ways, seeing it as a complex product to be manufactured, as a stimulus to reshaping the environment, as an object that has altered social behavior, and as a problem solver and problem maker.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Summer
Pre-Requisite(s): UN 2002
SS 3540 - History of Michigan
The history of Michigan from before European settlement to the present.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Summer - Offered alternate years beginning with the 2001-2002 academic year
Pre-Requisite(s): UN 1002 or UN 1003

SS 3541 - The Copper Country
Examines the social, labor, and technological history of the Copper Country from the frontier era until the shutdown of the mines.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring, Summer
Pre-Requisite(s): UN 1002 or UN 1003

SS 3550 - Europe to 1650
History of Europe from earliest times to 1650.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Pre-Requisite(s): UN 1002 or UN 1003

SS 3551 - Europe in the Modern Era
A study of European history from 1650 to the present.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Pre-Requisite(s): UN 1002 or UN 1003

SS 3552 - Renaissance & Reformation
The history of Europe from 1300 to 1650.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall - Offered alternate years beginning with the 2002-2003 academic year
Pre-Requisite(s): UN 1002 or UN 1003

SS 3555 - History of Canada
History of Canada from the frontier era until the shutdown of the mines.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Pre-Requisite(s): UN 1002 or UN 1003

SS 3560 - History of England I
The social, economic, and political history of England to 1714.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Pre-Requisite(s): UN 1002 or UN 1003

SS 3561 - History of England II
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: Fall - Offered alternate years beginning with the 2000-2001 academic year
Pre-Requisite(s): UN 1002 or UN 1003

SS 3570 - History of Canada
Political, social, economic, and cultural development of Canada from earliest European settlement to the present.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Pre-Requisite(s): UN 1002 or UN 1003

SS 3580 - Technology and Western Civilization
An overview of the evolution of technology in Western civilization from classical antiquity to mid-twentieth century. In addition, the course looks at ways technology influenced development of Western civilization and ways values of Western civilization have conditioned Western technology.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall - Offered alternate years beginning with the 2000-2001 academic year
Pre-Requisite(s): UN 2002

SS 3600 - American Foreign Policy
Explores the nature, sources, and institutions associated with the making of American foreign policy, paying attention to explanations for American behavior and to current problems for policy. Reviews major events in U.S. diplomatic history.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring - Offered alternate years beginning with the 2000-2001 academic year
Pre-Requisite(s): UN 2002

SS 3610 - International Law
Explores the principles, content, and logic of public international law, the law of nations. Students brief cases, prepare longer briefs to defend a side in a moot court, and engage in a moot court.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring - Offered alternate years beginning with the 2000-2001 academic year
Pre-Requisite(s): UN 2002

SS 3620 - International Environmental Technology Policy
Explores the relationship between markets and government policies in moving national economies and corporations toward "greener" technology choices. Topics may include industrial ecology, regulation, innovation, and pollution prevention. Course employs examples from U.S., Canada, EU, and Japan. When possible, students work on a real-life project for a client.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring - Offered alternate years beginning with the 2001-2002 academic year
Pre-Requisite(s): UN 2002

SS 3630 - Environmental Policy and Politics
A broad survey of how environmental policy making actually works in the U.S. Covers both environmental policy processes and politics, and the major environmental policies themselves for control of air pollution, water pollution, hazardous wastes, and other major environmental problems.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Pre-Requisite(s): UN 2002

SS 3640 - Selected Topics in Cyber-Law
Applies legal and ethical principles to evolving computer technology. Explores current legal issues such as surveillance, privacy, free speech, crime, encryption, on line contracting, intellectual property and censorship, as well as legislative efforts to resolve these and other computing dilemmas.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall - Offered alternate years beginning with the 2005-2006 academic year
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): UN 2002(C)

SS 3650 - Intellectual Property Law, Technology, Society and Innovation
Principles of intellectual property law, addressing legal and contemporary policy issues in copyright, trademark and patent and how the law impacts the balance between property protections, technological innovation and public access. Emphasizes learning through lectures, case studies and simulations.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall - Offered alternate years beginning with the 2006-2007 academic year
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore

SS 3660 - American Constitutional Law
Introduces the U.S. Constitution and how it has been interpreted by the Supreme Court over time. Explores historical, social and political consequences of major constitutional themes such as federalism, judicial review, and evolving view of individual rights and liberties.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2005-2006 academic year
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore

SS 3700 - Industry and Society
Examines how the development of modern industry has transformed society by creating a new class of individuals (industrial workers), a new form of the enterprise (the modern industrial enterprise), and a new form of the state (the industrial state).
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall - Offered alternate years beginning with the 2002-2003 academic year
Pre-Requisite(s): UN 2002

SS 3710 - Social Problems
Examines both the social construction of social problems and substantive problems confronting modern society by considering the distinct understandings of social problems offered by the two major theoretical traditions in sociology and analyzing specific macro and micro social problems.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring, Summer - Offered alternate years beginning with the 2002-2003 academic year
Pre-Requisite(s): UN 2002

SS 3720 - Social Psychology
Survey of social, cultural, and cognitive influences on individual and group behavior. Introduces attitude formation, social conformity, personal perception, aggression, cooperation, and interpersonal and intergroup relations.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring, Summer
Pre-Requisite(s): UN 2002
SS 3740 - Sociology of Family
Survey of marital and family relationships, which includes an examination of sex roles, courtship and mate selection, marital adjustment, sexual behavior, parenting, divorce, and the social forces that bring about changes in family patterns. Students should have completed six credits in Social Sciences to be successful in this course.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): UN 2002

SS 3750 - Social Inequality
A critical assessment of social and cultural processes associated with group-based or categorical patterns of inequality. Examines the creation, persistence, and attempts at reduction of structured inequality based on categorical factors such as social class, race, ethnicity, and gender. May explore other significant sources of social inequality.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2001-2002 academic year
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): UN 2002

SS 3760 - Human Dimensions of Natural Resources
Uses sociological concepts to cover facets of human relationships to natural resources, including human values, beliefs, and attitudes regarding the environment; rural resource-dependent communities; natural resource professions and expert knowledge; and the history of American perspectives on the environment.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Pre-Requisite(s): UN 2002

SS 3800 - Energy Technology and Policy
The many roles of energy in our energy-dependent world, focusing on fuel and technology choices, trends, and policies. Emphasizes current energy dilemmas and environmental challenges, such as the risk of global climate change. Field trips to local solar homes and energy companies.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2001-2002 academic year
Pre-Requisite(s): UN 2002

SS 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 2002

SS 3810 - Anthropology of Science and Technology
An anthropological study of technological developments and scientific knowledge in different cultures. Examines how modes of thought in the 20th century have influenced the development of science and technology in the West. Utilizes case studies from anthropology to compare Western and non-Western approaches to scientific observation and technological choice.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2001-2002 academic year
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): UN 2002

SS 3820 - 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: 2.0
Lec-Rec-Lab: (2-0-0)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): UN 2002

SS 3850 - Environmental Toxicology and Society
Investigates the social consequences of environmental poisons on human health and communities, with a focus on global effects and the unequal burden of toxic exposure. Toxicology lectures cover testing methods, bioactivation, carcinogenic and teratogenic effects, and target organs. Discussion covers case studies of community poisoning, toxins regulation, and political debate.
Credits: 3.0
Lec-Rec-Lab: (1-2-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2000-2001 academic year
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): UN 2002

SS 3890 - Industry & the World Economy
Examines the impact of industry and industrial transformations at the local, regional, state, national, and global level. Analyzes topics such as the process of technological transformation, the modern corporation, the environmental consequences of industry, and the corporation and the nation state.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall - Offered alternate years beginning with the 2001-2002 academic year
Pre-Requisite(s): UN 2002

SS 3910 - Histories and Cultures
Covers selected topics in world history, geography, or anthropology. Important concepts are the relationship between societies and regional geography, the sources and patterns of major cultures, and transformations of social, cultural, political, and economic institutions over time. May be repeated if topic differs.
Credits: 3.0; Repeatable to a Max of 9
Lec-Rec-Lab: (3-0-0)
Semesters Offered: On Demand
Pre-Requisite(s): UN 1002 or UN 1003

SS 3920 - Topics in Anthropology/Archaeology
Survey of a major branch of American anthropology or archaeology, or a specific time period or region. Topics may include North American prehistory, experimental archaeology, applied anthropology, economic anthropology, or other specialized themes. Readings will emphasize both theoretical and substantive contributions. May be repeated if topics differ.
Credits: 3.0; Repeatable to a Max of 9
Lec-Rec-Lab: (3-0-0)
Semesters Offered: On Demand
Pre-Requisite(s): UN 1002 or UN 1003

SS 3930 - Environmental Issues
Covers different environmental issues from year to year. Examples include air pollution, water pollution, endangered species, public land management, and toxics. Each course provides an in-depth exposure to the course topic, covering its sociopolitical and environmental components. May be repeated if topic differs.
Credits: 3.0; May be repeated
Lec-Rec-Lab: (3-0-0)
Semesters Offered: On Demand
Pre-Requisite(s): UN 2002

SS 3940 - World Affairs
The study of current issues and themes in world affairs and of significant world tension areas. Detailed examination of central issues in selected recent regional or international conflicts or high profile internal problems in selected countries.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: On Demand
Pre-Requisite(s): UN 2002

SS 3950 - Topics in American History
Examines an important theme, topic, or era in the development of American society, ranging from the colonial era up to the present. May include such topics as the Vietnam War, sports in America, American vernacular architecture, or urban America, all from a historical viewpoint. May be repeated if topic differs.
Credits: 3.0; Repeatable to a Max of 9
Lec-Rec-Lab: (3-0-0)
Semesters Offered: On Demand
Pre-Requisite(s): UN 1002 or UN 1003

SS 3960 - International Experience
Offers a means for crediting students for specific activities in study abroad programs that immerse them in foreign culture, society, and intellectual settings. It is applicable to varied study abroad and exchange programs offered by MTU.
Credits: variable to 9.0; Repeatable to a Max of 9
Semesters Offered: On Demand

SS 3990 - Topics in the Social Sciences
Examines an important theme or topic in the social sciences, such as social theory, work and society, or the engineer in American society. May be repeated if topic differs.
Credits: variable to 3.0; Repeatable to a Max of 9
Semesters Offered: On Demand
Pre-Requisite(s): UN 2002
SS 4000 - Independent Study
Independent study of topic of special interest with assistance and supervision from appropriate faculty.
Credits: variable to 3.0; Repeatable to a Max of 9
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of instructor required

SS 4001 - History of Social Thought
An intensive survey of the literature of 19th-20th century history of social thought, including the writings of Marx, Durkheim, Weber, and other prominent anthropologists, sociologists, and political philosophers.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2006-2007 academic year
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): UN 2002

SS 4010 - Social Science Methods
Covers basic concepts and methods used in conducting empirical research in the social sciences. Topics include research design, hypothesis testing, measurement of concepts, and computer-based data analysis. Students should have completed six credits of Social Sciences to be successful in this course.
Credits: 4.0
Lec-Rec-Lab: (3-1-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2000-2001 academic year
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): UN 2002 and (PSY 2720 or MA 2720 or BA 2100)

SS 4020 - Methods of Teaching Social Studies
Application of learning and instructional theories and practice to the teaching of social studies. Emphasis will include application of state and national education standards and relevant assessment strategies for social studies. Requires admission in the Teacher Education program by the Department of Education.
Credits: 2.0
Lec-Rec-Lab: (0-2-0)
Semesters Offered: Spring
Restrictions: Permission of department required; May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): ED 4700(C)

SS 4030 - Senior Project
Supervised research project as a capstone to a major. Students work with faculty member on design, research, and written report for a project defined by the student's interest and/or major.
Credits: 3.0; May be repeated
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Restrictions: Must be enrolled in one of the following Class(es): Senior
Pre-Requisite(s): UN 2002

SS 4100 - American Indian Political Issues
Exploration of contemporary relationships among American Indians and members of non-Indian communities, focusing on economic resource issues and on the relationship between tribes and other political entities, with emphasis on the Great Lakes region.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2007-2008 academic year
Pre-Requisite(s): UN 2002

SS 4200 - Environmental Anthropology
A seminar on the study of culture and politics in marginal environments and disadvantaged communities. Draws upon research in anthropology and geography to examine the interaction in the Americas, Asia, Africa, Europe, the Pacific, and the Arctic.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: On Demand
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): SS 2100

SS 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
Lec-Rec-Lab: (3-0-0)
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): Freshman
Pre-Requisite(s): SS 2100

SS 4405 - Geophysics for Archaeology
Principles and practice of non-invasive archaeological geophysics such as magnetometry, ground penetrating radar, and resistivity. Data interpretation will involve basic computation, computer and hand contouring, three-dimensional visualization programs, interpretation and archaeological significance. Activities will involve fieldwork, work on data, and short reports. The mathematical content of the class will be minimal.
Credits: 3.0
Lec-Rec-Lab: (2-0-1)
Semesters Offered: Fall - Offered alternate years beginning with the 2004-2005 academic year

SS 4500 - Historiography
The history of historical writing from Herodotus to the present.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall - Offered alternate years beginning with the 2001-2002 academic year
Pre-Requisite(s): UN 1002 or UN 1003

SS 4510 - Sustainable Futures I
Covers introductory and intermediate concepts of Sustainable Development. Explores methods/tools for assessing sustainability (economic, environmental, societal impacts) of current and emerging industrial technologies. Explores relationships between government policies and markets for introducing sustainable technologies into national economies and corporations.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): UN 2002

SS 4900 - Seminar in Social Sciences
An intensive seminar study of a topic of importance and special interest in the social sciences. Topics could focus on the history of anthropological theory or on world religious systems in comparison. May be repeated if topic differs.
Credits: variable to 3.0; Repeatable to a Max of 9
Semesters Offered: On Demand
Pre-Requisite(s): UN 2002

SS 4910 - Senior Orientation and Assessment
Assessment of learning and preparation for post-graduate work, professional training, or graduate school.
Credits: 1.0
Lec-Rec-Lab: (1-0-0)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Major(s): Social Sciences, Liberal Arts with History Opt; May not be enrolled in one of the following Class(es): Freshman, Sophomore

SS 4920 - Internship Experience
Internship, on or off campus, providing appropriate practical, professional experience in an area related directly to a student's course of study. Students work under professional supervision. Requires a written evaluation of the work.
Credits: variable to 6.0; Repeatable to a Max of 6
Semesters Offered: On Demand
Restrictions: Permission of department required; Must be enrolled in one of the following Major(s): Social Sciences, Liberal Arts with History Opt

Service Systems Engineering

SSE 2100 - The World of Service Systems Engineering
Introductory course covers the evolution of service systems engineering within the broader context of the engineering disciplines. Careers and professional practice within the discipline will be explored. Topics such as optimization, simulation, and quality tools will be introduced. Case studies in service systems engineering will be featured throughout.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall

SSE 2300 - Service Systems Dynamics and Design
Introduces a systems perspective in solving complex problems. How systems are designed and implemented will be a focal point of the course. Topics such as simulation, life cycle, and regulation will be introduced.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring

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, 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) and SSE 2300(C)
SSE 3400 - Human Interactions in Service Systems
Understanding the social, cognitive, and cultural influences on individual and group behavior is the focus of the course. Methods for assessment of human perception, such as surveys, focus groups, and structured interviews, will be introduced. The design of the service interface for human interaction will also be explored.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Pre-Requisite(s): SSE 2300(C) and PSY 2000

SSE 3500 - Operation of Service Systems
Focuses on the operation of service systems in a customer-focused environment. Topics will include work task breakdown, performance measurement, 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: Fall
Pre-Requisite(s): MA 3720 and SSE 3400(C)

SSE 3600 - Optimization and Adaptive Decision Making
Techniques in optimization and adaptive decision making will be introduced. The fundamentals in linear, integer, and goal programming will be applied to real-world problems with a service systems focus. Adaptive decision making techniques including Bayesian analysis, fuzzy systems, and neural networks will also be investigated.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Pre-Requisite(s): SSE 3500 and BA 2330 or (ENT 4955 and ENT 4951)

SSE 4600 - Managing Risk
Risk definition and identification in terms of financial, human, legal, and physical constraints will be introduced. Techniques for analyzing and managing risk such as FMEA and Reliability studies will be covered. Other topics will include risk elimination, mitigation, and tolerance.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Pre-Requisite(s): MA 3720

Surveying
SU 1500 - Data Collection Systems
Familiarization to modern data collectors used in conjunction with total stations and GPS receivers. Digital levels with onboard data collectors will also be introduced. Transferring, processing and displaying survey data within various systems using real data will be demonstrated.
Credits: 1.0
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Major(s): Surveying Engineering

SU 2000 - Introduction to Surveying and GIS
Surveying topics will include distance measurements, leveling, angles, directions, traversing, horizontal and vertical curves, percent grade, and coordinate geometry. GIS topics will include sources of GIS data, spatial data models, GIS data structures, GIS topology, as well as query and feature selection in GIS.
Credits: 2.0
Lec-Rec-Lab: (0-1-2)
Semesters Offered: Fall, Spring, Summer

SU 2150 - Fundamentals of Surveying
Introduction to surveying principles as applied to the measurement of distances, directions, and elevations. Topics include taping, leveling, traversing, topographic surveys, construction surveys, U.S. public land surveys, the use of modern instrumentation, and computer applications.
Credits: 4.0
Lec-Rec-Lab: (0-2-6)
Semesters Offered: Fall

SU 3110 - Surveying Field Practice
Students enrolled in this course perform several survey projects from field to finish using conventional surveying equipment and software.
Credits: 4.0
Lec-Rec-Lab: (0-2-6)
Semesters Offered: Fall
Pre-Requisite(s): SSE 2150 or SU 2000

SU 3150 - Principles of Geodesy
Concepts of astronomy and geodesy that are relevant to the practice of surveying. Covers theory of, field techniques, and computations involved in the determination of true north, an introduction to the figure of the earth and its geometric and physical characteristics, geodetic datums, and coordinate systems.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): MA 1140 or MA 1160 or MA 1161 and SU 3110(C)

SU 3180 - Boundary Surveying Principles
Interpretation of property descriptions used to establish land boundaries. Resolving conflicts in boundary descriptions as well as conflicts in evidence. Review doctrines pertaining to transferring title, the role of the surveyor in issuing opinions on boundary location in boundary disputes.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): SU 2220

SU 3250 - Survey Measurements and Adjustments
Presents errors in surveying measurements and their effect on computed values. Discusses analysis of measurements and errors based on statistical principles and presents adjustment techniques based on least squares principle.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): (MA 2320 or MA 2321 or MA 2330) and (MA 2710 or MA 3710 and SU 3110)

SU 4100 - Geodetic Positioning
Introduces the instruments and procedures used in surveying projects that require a high order of accuracy. Discusses some conventional instruments and techniques but the greater emphasis is on GPS techniques.
Credits: 3.0
Lec-Rec-Lab: (0-2-3)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): SU 3150 and SU 3250

SU 4140 - Photogrammetry
Basic principles of photogrammetry and its role as a technology for spatial data collection. Use of photogrammetry in the fields of surveying, engineering, and geographic information management will be discussed.
Credits: 3.0
Lec-Rec-Lab: (0-2-3)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): SU 3110
**Technology**

**TE 1010 - 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: 2.0

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

Semesters Offered: Fall, Summer

**TE 2000 - Directed Study in Technology**

Students undertake a directed study in an approved technology topic under the guidance of a School of Technology faculty member. The course of study will be academic in nature and is decided upon between the student and the faculty member.

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

Semesters Offered: On Demand

Restrictions: Permission of instructor and department required; Must be enrolled in one of the following College(s): School of Technology; May not be enrolled in one of the following Class(es): Junior, Senior

**TE 3956 - Industrial Safety Management**

Occupational safety and health standards and codes. Hazard recognition, accident costs, accident prevention, ethics and administration.

Credits: 3.0

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

Semesters Offered: Fall, Spring

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

**TE 4000 - Independent Study in Technology**

Students undertake an independent study in an approved technology topic under the guidance of a School of Technology faculty member. The course of study may either be research or academic and is decided upon between the student and faculty member.

Credits: variable to 3.0; Repeatable to a Max of 8

Semesters Offered: On Demand

Restrictions: Permission of instructor and department required; Must be enrolled in one of the following College(s): School of Technology; May not be enrolled in one of the following Class(es): Junior, Senior

**TE 4001 - Special Topics in Technology**

Topics of special interest in technology will be offered depending on student demand and faculty expertise.

Credits: variable to 4.0; Repeatable to a Max of 8

Semesters Offered: On Demand

Restrictions: Permission of instructor and department required; Must be enrolled in one of the following College(s): School of Technology

**UN 1000 - Frameworks for Success**

An introduction to university life, exploring ways to become a more effective student focusing on personal and professional habits necessary for success. Topics include academic skill development, time management, and university resources.

Credits: 1.0

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

Semesters Offered: Fall, Summer

**UN 1001 - Perspectives on Inquiry**

Writing-intensive course which engages students in college level inquiry. Students develop fundamental intellectual habits, understand how to integrate various perspectives on knowledge, and begin to learn how to meet the changing needs of a global, technological, diverse, and environmentally sensitive society.

Credits: 3.0

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

Semesters Offered: Fall, Spring, Summer

Restrictions: Must be enrolled in one of the following Class(es): Freshman

**UN 1002 - World Cultures**

Examines diversity and change around the globe from perspectives of social sciences, humanities, and arts; explores human experience from prehistory to present. Classroom lectures accompanied by films, live performances, and guest speakers. One complete year of a single foreign language plus World Cultures (UN1003, 1-credit-activities) substitutes for World Cultures.

Credits: 4.0

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

Semesters Offered: Spring, Summer

Restrictions: Must be enrolled in one of the following Class(es): Freshman

**UN 1003 - World Cultures Activities**

Activities portion of World Cultures. Limited to enrollment by students choosing the modern language option of one full year of a single foreign language to fulfill their World Cultures requirement.

Credits: 1.0

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

Semesters Offered: Spring

Restrictions: Must be enrolled in one of the following Class(es): Freshman

**UN 1010 - Creating Your Success**

Introduction to strategies for creating academic, professional and personal success. Emphasis is on determining individual priorities, improving self-management and developing critical thinking skills. Guided journal writing will be used to explore these strategies.

Credits: 1.0; Repeatable to a Max of 3; Graded Pass/Fail Only

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

Semesters Offered: Fall, Spring, Summer

**UN 1100 - Pavlis Global Technological Leadership Seminars**

Introduction to leadership styles, electronic portfolio development and profile testing. Seminars are designed to familiarize developing leaders with technological, economical, cultural, environmental, and social issues important in today's globalizing world and provide. Students will have opportunities to interact with leaders.

Credits: 1.0

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

Semesters Offered: Fall

**UN 1200 - Pavlis Global Technological Leadership Seminar 2**

Introduction to leadership principles and continued portfolio development. Seminars are designed to explore technological, economical, cultural, environmental, and social issues important in a globalizing world. Students will have opportunities to interact with leaders.

Credits: 1.0

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

Semesters Offered: Spring

**UN 2001 - Revisions: Oral, Written, and Visual Communication**

Oral, Written, and Visual Communication. Writing-intensive course which builds on students' previous courses by providing advanced, direct instruction in communication. Students look closely at the communication practices of civic groups and apply what they learn to their own spoken, written, and visual work. Class projects ask students to fit the communications they make to interesting, sometimes difficult, situations and audiences.

Credits: 3.0

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

Semesters Offered: Fall, Spring, Summer

Restrictions: Must be enrolled in one of the following Class(es): Freshman, Sophomore

Pre-Requisite(s): UN 1001 and (UN 1002 or UN 1003)
UN 2002 - Institutions
From families to governments, to markets, to our interactions with the natural environment, institutions organize collective human action. Introduces students to the nature and role of institutions in shaping today's world. Specific topics will vary by section, but all sections address a set of core questions and concepts.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring, Summer
Restrictions: Must be enrolled in one of the following Class(es): Sophomore

UN 2100 - Pavlis Global Technological Leadership Seminar 3
Advanced leadership styles, group leadership activities and advanced portfolio development. Seminars are designed to provide opportunities to explore common perceptions of leadership, technology, culture, globalization and communication. Students will have opportunities to interact with leaders.
Credits: 1.0
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Fall

UN 2300 - Leadership for a Global Technological World
Introduction to the fundamentals of leadership: personality traits, interpersonal skills & teamwork, leadership styles, situational leadership, decision-making and ethics. Emphasizes leading in a global and technology-intensive environment and developing leadership through practice.
Credits: 3.0
Lec-Rec-Lab: (3-0-3)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Class(es): Sophomore, Junior
Pre-Requisite(s): UN 2100

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 2990 - Special Topics - Interdisc.
The study of interdisciplinary special topics as specified by section title.
Credits: variable to 6.0; Repeatable to a Max of 97
Semesters Offered: On Demand
Restrictions: Permission of instructor required

UN 3002 - Undergraduate Cooperative Education Laboratory
Credits may count as free or technical electives based on student's academic department. Requires 2.20 GPA or better, registration with the Office of Cooperative Education, and acceptability by a recognized employer. Transfer students must have completed at least one full-time semester on the MTU campus.
Credits: variable to 2.0; May be repeated
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of instructor and department required; May not be enrolled in one of the following Level(s): Graduate; Must be enrolled in one of the following Class(es): Sophomore, Junior, Senior

UN 3003 - Undergraduate Cooperative Education Laboratory - Technical Elective
Reserved for co-op assignments requiring additional or specialized training. Permission of the Co-op office and academic department is required. Requires GPA 2.20 or better, registration with the Office of Cooperative Education, and acceptability by a recognized employer. Transfer students must have completed at least one full-time semester on the MTU campus.
Credits: 3.0; May be repeated
Lec-Rec-Lab: (0-0-40)
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of instructor and department required; May not be enrolled in one of the following Level(s): Graduate; Must be enrolled in one of the following Class(es): Sophomore, Junior, Senior

UN 3100 - Pavlis Global Technological Leadership Seminar 4
Global aspects of leadership and advanced leadership practices. Seminars are designed to provide opportunities to deepen, complicate and challenge common perceptions of leadership, technology, culture, globalization and communication. Students will participate in leadership activities.
Credits: 1.0
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Fall

UN 3401 - Environmental Stewardship
Helps prepare the leaders of tomorrow to ensure environmental sustainability for future generations. Topics to be considered include air and water resources, land use issues, recreation and conservation issues and protection of valued systems.
Credits: 2.0
Lec-Rec-Lab: (1-0-1)
Semesters Offered: Summer
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): HU 3120

UN 3402 - Language of Business for Non-Business Majors
Provides an overview of business and management which will enhance the ability to lead in organizations. Includes the "language of business" (accounting, finance, and marketing), organizational structures, processes and strategies, leadership and change management, project management and business plan development.
Credits: 2.0
Lec-Rec-Lab: (1-1-0)
Semesters Offered: Summer
Restrictions: May not be enrolled in one of the following College(s): School of Business & Economics; Must be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): HU 3120

UN 3403 - Language of Technology
Exposes students to the tools, tactics, and resource needs associated with design and development of new products and technological systems. General topics include evolution of technology, the design process, and ethics. Specific topics may include nanotechnology, biotechnology, and environmental systems.
Credits: 2.0
Lec-Rec-Lab: (1-0-1)
Semesters Offered: Summer
Restrictions: May not be enrolled in one of the following College(s): College of Engineering, School of Technology; Must be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): HU 3120

UN 3404 - Cultural Immersion
Allows students to explore the culture of their international experience. They will think about how to live, learn, share, and gain leadership skills in a foreign environment. Students will gain insight into how to work with and learn from cultural differences with the goal of seeing the world and their leadership role in new ways.
Credits: 2.0
Lec-Rec-Lab: (0-1-1)
Semesters Offered: Summer
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): HU 3120

UN 3405 - Global Leadership Practicum
Students will spend time abroad participating in a variety of leadership experiences. This will include at least one major leadership project. Upon returning, students will spend two weeks on campus writing reports and hosting a summer leadership institute.
Credits: 4.0
Lec-Rec-Lab: (0-0-12)
Semesters Offered: Summer
Restrictions: Permission of department required; Must be enrolled in one of the following Class(es): Freshman, Sophomore

Undergraduate Course Descriptions, 2007-08, Page 85 of 86
UN 4100 - Pavlis Leadership Practicum I
Serves as a capstone experience in leadership. Students will engage in discussions, make oral presentations, write a senior thesis, mentor other students and apply their leadership knowledge and skills by taking on a leadership role.

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 4050

UN 4200 - Pavlis Leadership Practicum II
Serves as a capstone experience in leadership. Students will engage in discussions, make oral presentations, write a senior thesis, mentor other students and apply their leadership knowledge and skills by taking on a leadership role.

Credits: 2.0
Lec-Rec-Lab: (0-1-2)
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
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. Refer to the Schedule Planning Center at www.admin.mtu.edu/em/students/plan/ or contact the Office of Student Records and Registration for information on refund dates for all other courses.

University Withdrawal—The following refund schedule applies when students drop all classes and leave the University. This does NOT apply to students making schedule adjustments who otherwise remain enrolled at 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 1st week</td>
<td>90%</td>
</tr>
<tr>
<td>2nd week</td>
<td>80%</td>
</tr>
<tr>
<td>3rd week</td>
<td>70%</td>
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<tr>
<td>4th week</td>
<td>60%</td>
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<tr>
<td>5th week</td>
<td>50%</td>
</tr>
<tr>
<td>6th week</td>
<td>40%</td>
</tr>
</tbody>
</table>

Room and Board Refunds—Refunds of room-and-board charges will be prorated on the basis of the number of weeks used.

Enrollment Deposit—The enrollment deposit is refundable within six months of leaving the University. Unpaid charges such as library fines, traffic fines, lab 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. Refund checks cannot be picked up in the Cashier’s or Accounting Offices. Checks are mailed or direct deposited into the student’s checking or savings account.
Financial Aid Refund Policy

Return of Title IV Funds
Students who completely withdraw from all courses prior to completing more than 60 percent of a semester will have their eligibility for aid recalculated based on the percent of the semester completed. This policy shall apply to all students who withdraw, drop out, or are dismissed from the University and receive financial aid from Title IV funds.

The term "Title IV Funds" refers to the following federal financial aid programs: Federal Direct Unsubsidized Loan, Federal Direct Subsidized Loan, Federal Direct PLUS Loans, Federal Perkins Loan, Federal Pell Grant, Federal Supplemental Educational Opportunity Grant, Academic Competitiveness Grant and National Science and Mathematics Access to Retain Talent Grant (SMART).

Title IV aid is earned in a prorated manner on a per diem basis up to and including the 60 percent point in the semester. Title IV funds and all other aid is viewed as 100 percent earned after that point in time.

The percentage of Title IV aid earned shall be calculated as follows:

\[
\text{Percent of Title IV aid earned} = \frac{\text{Number of days completed by the student}}{\text{Total number of days in the semester}^*}
\]

* The total number of days in the semester includes weekends, but does not include any scheduled breaks of more than five days.

A student's withdrawal date is determined by the University as (1) the date the student began the university's withdrawal process or officially notified the Office of Records and Registration of intent to withdraw; or (2) the midpoint of the semester for a student who leaves without notifying the university; or (3) the student's last date of attendance at a documented academically related activity.

University's Portion to be Returned—The percentage of Title IV aid unearned (i.e., to be returned to the appropriate program) shall be 100 percent minus the percent earned. Any unearned aid to be returned by the University is the lesser of (1) the entire amount of unearned aid or (2) the total institutional charges multiplied by the percentage of unearned aid.

Unearned Title IV aid shall be returned according to the following priority up to the amount received for the semester:

1. Direct Unsubsidized Loan
2. Direct Subsidized Loan
3. Perkins Loan
4. Direct PLUS Loan (Graduate Student)
5. Direct PLUS Loan (Parent)
6. Federal Pell Grant
7. Academic Competitiveness Grant
8. National SMART Grant
9. Federal SEOG

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 45 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


This policy defines the minimum requirements for financial aid eligibility at Michigan Tech. Note that other types of financial aid (e.g., scholarships) may have more stringent requirements.

Students who do not meet the GPA requirements after any semester are not considered to be making satisfactory progress, and the affected financial aid for subsequent semesters will be canceled with the following exception: students who do not meet the GPA requirement after their first semester at Michigan Tech will be placed on financial aid probation and will remain eligible for financial aid for one semester. Students not meeting the schedule of credits passed after spring semester are not considered to be making satisfactory progress. Both GPA and credits passed requirements must be met for aid to be reinstated.

Requirement 1. Minimum Grade Point Average
Every student must maintain, at the end of each semester, a cumulative grade point average of at least

- 1.70 as a freshman (0–29 credits)
- 1.80 as a sophomore (30–59 credits)
- 2.00 as a junior (60–89 credits)
- 2.00 as a senior (90 or more credits)
- 2.00 as a postgraduate student
- 3.00 as a graduate student (MS, PhD)

Requirement 2. Minimum Credits Passed
Every student must adhere to the following schedule of credits passed, even if the academic major is changed. Audited courses (U or V) do not count toward credits earned. Transfer students, see below for additional information.
### Credits Earned at Michigan Tech

<table>
<thead>
<tr>
<th>Full-Time Semesters at Michigan Tech</th>
<th>Undergraduate Student</th>
<th>MS Student</th>
<th>PhD Student</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>9</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>1.5*</td>
<td>13</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>2</td>
<td>18</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>3</td>
<td>28</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td>4</td>
<td>38</td>
<td>16</td>
<td>16</td>
</tr>
<tr>
<td>5</td>
<td>49</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>6</td>
<td>60</td>
<td>24</td>
<td>24</td>
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<tr>
<td>7</td>
<td>71</td>
<td>28</td>
<td>28</td>
</tr>
<tr>
<td>8</td>
<td>82</td>
<td>32</td>
<td>32</td>
</tr>
<tr>
<td>More than 8</td>
<td>—</td>
<td>no aid</td>
<td>—</td>
</tr>
<tr>
<td>9</td>
<td>94</td>
<td>no aid</td>
<td>36</td>
</tr>
<tr>
<td>10</td>
<td>106</td>
<td>—</td>
<td>40</td>
</tr>
<tr>
<td>11</td>
<td>118</td>
<td>—</td>
<td>44</td>
</tr>
<tr>
<td>12</td>
<td>130</td>
<td>—</td>
<td>48</td>
</tr>
<tr>
<td>More than 12</td>
<td>no aid</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>13</td>
<td>—</td>
<td>—</td>
<td>52</td>
</tr>
<tr>
<td>14</td>
<td>—</td>
<td>—</td>
<td>56</td>
</tr>
<tr>
<td>More than 14</td>
<td>—</td>
<td>—</td>
<td>no aid</td>
</tr>
</tbody>
</table>

### Eligibility Defined

All students, regardless of whether they are receiving aid, have a limited number of semesters for which they are eligible for such aid. For example, undergraduates who have attended Michigan Tech for 8 full-time semesters may be eligible for another 4 semesters of aid, regardless of whether or not they have received aid in the past. Every semester an undergraduate student is enrolled for 12 or more credits at the end of the official add period counts as a full time semester. If an undergraduate student is enrolled for 6-11 credits, the full-time semesters increase by one half. Full-time semesters will not increase during the semesters undergraduate students carry fewer than 6 credits.

### Associate Degree Students

The undergraduate schedule of credits passed applies to students in associate degree programs. If the full-time semesters exceed 6, the student is not considered to be making satisfactory progress. Appeals based on the fact that some credits earned at Michigan Tech were used for a previous degree should be presented to the Financial Aid Office.

### Students with Transfer Credit

The appropriate schedule of credits earned applies to students with transfer credit, with one additional step. The total number of credits transferred to Michigan Tech is divided by 15 to calculate full-time transfer semesters. That number is then subtracted from the total number of full-time semesters of eligibility at Michigan Tech to determine the number of semesters of eligibility remaining. If the combination of full-time semesters at Michigan Tech plus the full-time semesters calculated from transfer credit exceed the maximum allowed (12), the student is not considered to be meeting satisfactory progress requirements for financial aid. Example: A student who is transferring 60 semester credits to Michigan Tech would have 4 full-time transfer semesters (60 credits/15=4 semesters). The student in this example would have 8 full-time semesters of eligibility remaining (12 semesters maximum -4 calculated transfer semesters = 8 semesters of remaining eligibility).
Students Working on Second Undergraduate Degree—Undergraduate students who have received their first bachelor's degree from another institution are considered to be making unsatisfactory progress when their full-time Michigan Tech semesters exceed 6. Michigan Tech undergraduates seeking a second bachelor's degree must follow the schedule of credits passed for undergraduate students.

Appeals and Reinstatements
Because financial aid dollars are applied to the first billing each semester, and the progress status is not determined until semester-end grades are processed, necessary adjustments will appear on a subsequent billing of the semester following a change of progress status.

If completion of temporary grades (I or X) or other transcript changes (e.g., grade changes) warrant reinstatement, the student should notify the Financial Aid Office by the end of the semester following unsatisfactory progress.

Students not meeting the satisfactory progress requirements because of mitigating or extenuating circumstances may request reinstatement of financial aid by submitting a Satisfactory Progress Appeal Request Form along with the specified documentation. This form can be obtained from the Financial Aid Office or downloaded from the Financial Aid Office website. Appeals should be submitted to the Financial Aid Office no later than Tuesday of the first week of the semester following unsatisfactory progress. If a student's appeal is approved, when appropriate, the full-time semesters will be adjusted allowing continued eligibility.

NCAA Eligibility Requirements
The National Collegiate Athletic Association (NCAA) requires that student-athletes be in good academic standing and maintain satisfactory academic progress toward a baccalaureate degree to remain eligible to represent an institution in intercollegiate athletics competition. The following table lists the total number of credits that must be 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.

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).

<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>• 18/27 credits earned during academic year</td>
<td>• 18 credits earned during academic year</td>
<td>• 18/27 credits earned during academic year</td>
</tr>
<tr>
<td>• 1.80 GPA for graduation</td>
<td>• 1.80 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>• Declaration of degree program</td>
<td>• Declaration of degree program</td>
</tr>
<tr>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
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% of the 24 credits) and maintain the following grade point average:

**GPA Requirements**
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, including those currently enrolled, must successfully complete at least six (6) semester or quarter 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 U.S. Department of Veterans Affairs (USDVA) will be notified in writing. Requests for reinstatement of VA benefits will be made only after a veteran has been removed from probation and has attained a cumulative GPA of 2.00 (on a 4.00 scale).
2. Student veterans not registered by the fifth day of instruction will be terminated from benefits.
3. All student veterans receiving benefits must schedule a minimum of 12 credits of their major core requirements to receive full benefits.
4. 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.
5. Two-year technology courses are not authorized for certification for student veterans enrolled in a four-year program.
6. All accepted applicants who are requesting veterans' benefits will be given credit for previous training, where appropriate. The total length of time will be reduced proportionately toward completion of degree requirements. All students receiving veterans' benefits must submit transcripts and other documents showing credit for previous training to the Admissions Office by the end of the first term of enrollment. Failure to do so will result in no further certification for veterans' benefits until those transcripts have been provided.

**Financial Aid**
For scholarship information, go to the Financial Aid website at [www.finaid.mtu.edu](http://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. In each department, our faculty set goals for student learning that go beyond the content of any single course. Examples include "a unified and integrated understanding of their major field as a whole, skills for critical thinking and systematic analysis," and "good oral and written communications skills."

To measure students' success in achieving these learning goals, we collect samples of student work, administer special exams, and conduct student interviews throughout the year. The purpose of this assessment is to identify opportunities for improvement of our curricula and student life by measuring the success of students as a group. The university also participates in national surveys, such as the National Survey on Student Engagement.

The results of assessment activities are summarized each fall as a report and discussed by the faculty in each department as well as by the University Assessment Council annually to determine how the curriculum and teaching practices may be revised to improve student learning. The University administration reviews assessment activities and uses informed findings to help make decisions about program growth.

Board of Control
(All terms expire December 31 of year indicated.)

<table>
<thead>
<tr>
<th>Name</th>
<th>Location</th>
<th>Term</th>
</tr>
</thead>
<tbody>
<tr>
<td>Russell A. Gronevelt</td>
<td>Plymouth, Michigan</td>
<td>2004–2010</td>
</tr>
<tr>
<td>Ruth A. Reck</td>
<td>Davis, California</td>
<td>2002–2010</td>
</tr>
<tr>
<td>Martha K. Richardson</td>
<td>Grosse Pointe Farms, MI</td>
<td>2005–2012</td>
</tr>
</tbody>
</table>

University Administrators
- President, Glenn D. Mroz
- Provost and VP for Academic Affairs, Lesley M. Lovett-Doust
- VP for Student Affairs, Les P. Cook
- VP for Administration, Ellen S. Horsch
- VP for Advancement, Shea McGrew
- VP for Governmental Relations, Sec'y, Board of Control, Dale R. Tahtinen
- VP for Research, David D. Reed
- Chief Financial Officer/Treasurer, Board of Control, Daniel D. Greenlee

Faculty Administration
- College of Engineering
  - Dean, Timothy J. Schulz
  - Associate Dean Research and Graduate Programs, Carl L. Anderson
- Department Chairs
  - Biomedical Engineering, Michael R. Neuman
  - Chemical Engineering, Michael E. Mullins
  - Civil and Environmental Engineering, Neil J. Hutzler
  - Electrical and Computer Engineering, Leonard J. Bohmann, Interim
  - Engineering Fundamentals, Kris G. Mattila, Interim
  - Geological and Mining Engineering and Sciences, Wayne D. Pennington
  - Materials Science and Engineering, Mark R. Plichta
  - Mechanical Engineering-Engineering Mechanics, William W. Predebon

College of Sciences and Arts
Dean, Maximilian J. Seel
Associate Dean, Bradley H. Baltensperger
Department Chairs
Aerospace Studies (Air Force ROTC), Kerry L. Beaghan
Biological Sciences, John H. Adler
Chemistry, Sarah A. Green
Cognitive and Learning Sciences, Bradley H. Baltensperger
Computer Science, Linda M. Ott
Exercise Science, Health and Physical Education, Jason R. Carter
Humanities, Robert R. Johnson
Mathematical Sciences, Mark S. Gockenbach
Military Science (Army ROTC), Dallas L. Eubanks
Physics, Ravindra Pandey
Social Sciences, Bruce E. Seely
Visual and Performing Arts, Roger L. Held

School of Business and Economics
Dean, Christa L. Walck
Associate Dean, Terry D. Monson

School of Forest Resources and Environmental Science
Dean, Margaret R. Gale

School of Technology
Dean, Scott J. Amos

Graduate School
Dean, Jacqueline E. Huntoon

J. R. Van Pelt Library
Director, Phyllis H. Johnson

University Accreditation
Michigan Technological University is accredited by: North Central Association of Colleges and Schools, the Higher Learning Commission. Accreditation documentation may be reviewed in the Office of the Provost and Vice President for Academic Affairs.

North Central Association of Colleges and Schools, the Higher Learning Commission
30 North LaSalle St, Suite 2400
Chicago, IL 60602-2504
312-263-0456 and 800-621-7440; 312-263-7462 (fax)
www.ncahigherlearningcommission.org

In addition to the general accreditation, specific programs have been accredited, approved, or recognized by their respective agencies.

College of Engineering
The Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology (ABET) accredits the following engineering programs:

- biomedical engineering
- chemical engineering
- civil engineering
- computer engineering
- electrical engineering
- engineering (interdisciplinary or special focus)
- environmental engineering
- geological engineering
- materials science and engineering
- mechanical engineering

School of Technology
The Technology Accreditation Commission of ABET accredits the following engineering technology programs:

- electrical engineering technology
- mechanical engineering technology
**College of Sciences and Arts**
The Department of Chemistry offers American Chemical Society certified degrees and interdisciplinary options. Fourth-year instruction in the Clinical Laboratory Science 3+1 option is carried out in hospitals accredited by the National Accrediting Agency for the Clinical Laboratory Sciences (NAACLS).

The Michigan Board of Education approves the teacher certification programs.

**School of Business and Economics—AACSB International**
The BSBA degree program of the School of Business and Economics is accredited by AACSB International -The Association to Advance Collegiate Schools of Business, the premier business accrediting organization in the US. Only about 400 US business programs (of 1,200 nationwide) have earned this distinction.

AACSB International
600 Emerson Road, Suite 300
St. Louis, MO. 63141-6762 USA
314-872-8481; 314-872-8495 (fax)

**School of Forest Resources and Environmental Science**
The Society of American Foresters accredits the forestry program.

Society of American Foresters
6400 Grosvenor Lane
Bethesda, MD 20814-2198
301-897-8720; 301-897-3690 (fax).