

## Minors

### **Aerospace Studies Minor**

18 credits

*Department of Aerospace Studies*

This minor allows students to study one of our country's major instruments of national power, the United States military. The student will study and apply leadership as it is practiced in civilian and military institutions and develop an understanding of the nature of international conflict; the formation of national security policy; the use of aircraft, spacecraft, and information to create political and military effects; and the development and organization of the United States military forces. This minor is an excellent foundation for students planning a career in the aerospace industry or Department of Defense.

Required Courses--12 cr

AF 3001 Leadership Studies I 3

AF 3002 Leadership Studies II 3

AF 4001 National Security Affairs I 3

AF 4002 National Security Affairs II 3

Elective Courses--6 cr

Any AFROTC Dept course (not courses listed above; max of 4 credits)

Additional Electives

AR 1001 Basic Leadership/Management I 1

BA 3700 Organizational Behavior 3

CE 5406 Airport Planning and Design 3

HU 3120 Technical and Scientific Communications 3

SS 3505 Military History of the United States 3

SS 3600 American Foreign Policy 3

SS 3940 World Affairs

### **American Studies Minor**

18 credits

*Department of Social Sciences*

A minor in American Studies provides students with a concentration in U.S. history, politics, and social institutions. It draws from the disciplines of history, sociology, political science, anthropology, and literature. A minor in this field offers a perspective on American society that provides students with historical and socio-political depth with which to understand current affairs in the U.S.

Required Courses--18 cr

Choose 6 of the following courses:

HU 3510 The American Novel 3

SS 2500 The American Experience 3

SS 2600 American Government and Politics 3

SS 3500 Modern American History 3

SS 3505 Military History of the U.S. 3

SS 3510 History of American Technology 3

SS 3511 History of Science in America 3

SS 3515 History of American Architecture 3

SS 3520 U.S. Environmental History 3  
SS 3530 The Automobile in American 3  
SS 3540 The History of Michigan 3  
SS 3541 The Copper Country 3  
SS 3600 American Foreign Policy 3  
SS 3630 Environmental Policy and Politics 3  
SS 3700 Industry and Society 3  
SS 3710 Social Problems 3  
SS 3750 Social Inequality 3  
SS 3760 Human Dimensions of Natural Resources 3  
SS 3800 Energy Technology and Policy 3  
SS 3950 Topics in American History 3  
SS 4000 Independent Study [readings or research on American history, society, and politics ] 1-3  
SS 4100 American Indian Political Issues 3

## **Art Minor**

16 credits

### ***Department of Fine Arts***

The study of art adds breadth to the student's general university experience and depth to the student's studies in science, technology, and engineering through the honing of spatial skills and awareness. Students with a minor in art will have developed their creative and visual skills, will understand the elements and principles of design, will have an understanding of the history of civilization through their study of art, and will have the tools and incentives for life-long learning.

Required Courses--6 cr

FA 1150 Drawing I 3

FA 3300 Three Dimensional Design 3

Elective Courses--10 cr

Choose 3 credits from the following:

FA 2150 Drawing II 3

FA 2200 Watermedia I 3

FA 2300 Two Dimensional Design 3

Choose 3 credits from the following:

FA 3150 Life Drawing 3

FA 3200 Watermedia II 3

FA 3333 Sculpture 3

Choose 3 credits from the following:

FA 3330 Art History I 3

FA 3340 Art History II 3

Choose 1 credit from the following:

FA 4150 Advanced Drawing Studio 1

FA 4200 Advanced Watermedia Studio 1

FA 4300 Advanced Sculpture Studio 1

FA 4970 Fine Arts Final Project 1

## **Astrophysics Minor**

16 credits

### ***Department of Physics***

The astrophysics minor allows students to better understand the universe and includes discussions of black holes, general relativity, cosmic rays, and theories of the universe. In addition, students are exposed to the practical aspects of the measurement tools used, including data and image processing, optics, cosmic ray counting, and radio telescopes.

Required Courses--11 cr

PH 1600 Introductory Astronomy 2  
PH 2200 Univ Physics II Elec & Magnetism 3  
PH 4610 Stellar Astrophysics 3  
PH 4620 Galactic Astrophysics 3

Elective Courses--5-7 cr

Choose 5 additional credits (7 cr for Applied Physics majors) from the following:

EE 4254 Image Processing 3  
MA 3710 Statistical Methods II 3  
PH 3600 Introduction to Remote Sensing 2  
PH 5630 Imaging Systems 2  
PH 5910 Atmospheric Physics 2

## **Biochemistry Minor**

17 credits

*Department of Biological Sciences*

The courses required for the minor in biochemistry constitute a comprehensive introduction to the properties of biologically important molecules, mechanisms, and processes and provide the student with extensive information as well as practical laboratory experience. Major topics include the chemistry and purification of proteins, enzymes and enzyme kinetics, intermediary metabolism and regulation, bioenergetics, membrane structure and function, mechanisms and regulation of protein, DNA, RNA and polysaccharide synthesis and current techniques in gene cloning and protein engineering.

Required Courses--12 cr

BL 2100 Principles of Biochemistry 3  
BL 4010 Biochemistry I 3  
BL 4020 Biochemistry II 3  
BL 4030 Molecular Biology 3

Elective Courses

Choose two of the following:

BL 4040 Environmental Biochemistry 3  
BL 4820 Biochemical Lab Techniques I 2  
BL 4840 Molecular Biology Techniques 3

## **Biological Sciences Minor**

16 credits

*Department of Biological Sciences*

The courses required for this minor constitute a comprehensive view of the biological sciences. Students may follow either of two tracks. Track A has an emphasis on cellular and genetic organization of living systems, while track B provides an organismal emphasis. Entry to either track would be through prerequisites: either BL 1040 Principles of Biology or BL 2010 Anatomy and Physiology I.

### Cellular or Genetic Track

#### Required Courses--6 cr

BL 2100 Principles of Biochemistry 3

BL 2200 Genetics 3

#### Elective Courses--10 cr

Choose 10 credits minimum from the following:

BL 3210 General Microbiology 4

BL 3640 General Immunology 3

BL 4010 Biochemistry I 3

BL 4020 Biochemistry II 3

BL 4030 Molecular Biology 3

BL 4320 Histology 4

BL 4380 Cardio Pulmonary Physiology 3

### Organismal Track

#### Required Courses--6 cr\*

BL 2160 Botany 4

BL 2170 Zoology 4

#### Elective Courses--10 cr

Choose 10 credits minimum from the following:

BL 3190 Evolution 3

BL 3400 Principles of Ecology 4

BL 4090 Tropical Island Biology 2

BL 4230 Virology 3

BL 4740 Introduction to Mycology 3

BL 4860 Toxicology 3

\*Only 6 credits of the 8 required count toward the minor.

## **Chemistry Minor**

16-18 credits

### ***Department of Chemistry***

Chemistry is a foundation discipline underlying modern developments in material science, biology, medicine, and genetics. As these areas become subject to increased analysis and understanding at the molecular level, chemistry knowledge becomes ever more important. A chemistry minor can be a useful beginning to becoming a competent technology consumer and scientifically literate citizen. The program outlined below provides broad coverage of chemistry topics and affords a strong foundation in chemistry.

#### Required Courses--8-11 cr

CH 2212 OR CH 2252 Quant Analy OR Measurement Science 3-5

CH 2420 Organic Chemistry II 3

CH 3500 OR CH 3510 Phys Chem for Env & Life Sci OR Phys Chem I 2-3

#### Elective Courses--7-8 cr\*

Choose a minimum of 7-8 credits from the following:

CH 3520 Physical Chemistry II 3

CH 3521 Physical Chemistry Lab II 2

CH 4272 Process Analytical Chemistry 4  
CH 4310 Inorganic Chemistry 3  
CH 4311 Inorganic Chemistry Lab 2  
CH 4412 Spectroscopy of Organic Chemistry 3  
CH 4610 Intro to Polymer Sci 3  
CH 4620 Polymer Chemistry 3  
CH 4631 Polymer Science Lab 2  
CH 4641 Polymer Chemistry Lab 2  
CH 4710 Chemical Principles in Biology 3

\*None of these elective courses are required in any major except CH.

## **Communication Studies Minor**

18 credits

### ***Department of Humanities***

Communication studies focuses on how knowledge and power work, especially in the globalization of technical and consumer cultures. Students develop a range of knowledge and skills that include interpersonal communication; communication in organizations; the formation of community; cultural studies and popular culture; orality, literacy, electronic communication; language; and media studies.

Required Courses--12 cr

Choose one of the following prerequisite courses:

HU 2820 Communication and Culture 3  
HU 2830 Intro to Speech Communication 3

Contexts of Communication--choose three of the following:

HU 3820 Interpersonal Communication 3  
HU 3850 Cultural Studies 3  
HU 3840 Organizational Communication 3  
HU 4820 Modes of Communication 3  
HU 4830 Communication and Community 3  
HU 4840 Communication and Global Culture 3

Elective Courses--6 cr

Choose two of the following OR one from the following and one from Contexts of Communication; only one course may be at the 2000 level.

HU 2910 Language and Mind 3  
HU 2920 Language and Society 3  
HU 3860 Popular Culture 3  
HU 4625 Risk Communication 3  
HU 4703 Issues in Communication Ethics 3  
HU 4890 Topics in Communication 3

## **Computer Science Minor**

16 credits

### ***Department of Computer Science***

The minor in Computer Science provides a solid foundation in computer science through course work in problem solving, programming, data structures, software engineering, and foundations of computation.

Required Courses--6 cr

CS 2321 Data Structures 3  
CS 2311 Discrete Structures 3

Elective Courses--10 cr

Choose 10 credits from the following:

CS 3141 Team Software Project 3  
CS 3421 Computer Architecture 4  
CS 4121 Programming Languages 3  
CS 4311 Introduction to Computational Theory 3  
CS 4321 Introduction to Algorithms 3  
CS 4411 Introduction to Operating Systems 4  
CS 4611 Introduction to Computer Graphics 3

Upon the approval of the Computer Science Undergraduate Committee, other CS 3000- and CS 4000-level courses may be used in satisfying the requirements of the CS minor.

## **Earth Sciences Minor**

16 credits

*Department of Geological Engineering and Sciences*

A sequence of courses designed to give students a general background in the many facets of Geology and Earth Sciences.

Required Course\*--3 cr

GE 2000 Understanding the Earth 3

Elective Courses--13 cr

GE 2000 Understanding the Earth\*\* 3  
GE 2100 Environmental Geology\*\* 3  
GE 2300 Earth Mat 1: Mineralogy\*\* 3  
GE 2310 Earth Mat 2: Rocks & Minerals\*\* 3  
GE 2350 Structural Geology I\*\* 2  
GE 2400 Intro to Appl & Env Geophysics\*\* 4  
GE 2500 Introduction to Oceanography\*\* 3  
GE 2640 Atmospheric Observation/Meteorology\*\* 3  
GE 2900 Geology of Utah's Natural Parks\*\* 3  
GE 3000 Structural Geology II 2  
GE 3100 Depositional Systems 4  
GE 3200 Geochemistry 3  
GE 3320 Earth History and Paleoclimatology 3  
GE 3915 Introduction to Field Geology 3  
GE 3920 Geological Field Excursion 1-6  
GE 4100 Geomorphology & Glacial Geology 4  
GE 4150 Natural Hazards 3  
GE 4200 Applied Geochemistry 3  
GE 4300 Igneous & Metamorphic Petrology 4  
GE 4400 Near Surface Geophysics I 3  
GE 4410 Near Surface Geophysics II 3  
GE 4500 Plate Tectonics & Global Geophysics 3  
GE 4750 Struc Eval of Petroleum Prospects 3  
GE 4760 Engg Eval of Mineral Deposits 3

\*GE 2000 is a prerequisite for a number of elective courses. GE 2000 or GE 2100, if not taken as a required course, can be taken as an elective.

\*\*No more than 6 credits at the 2000 level will count toward the minor:

## **Ecology Minor**

16 credits

### ***School of Forestry & Wood Products and Department of Biological Sciences***

This minor provides students from many disciplines the opportunity to study ecology and develop an understanding of organismal interactions within the environment. It provides the foundations as well as an in-depth examination of both terrestrial and aquatic ecosystems.

Required Courses--7-8 cr

Select one course from group A and B:

#### Group A

BL 1040 Principles of Biology 4

BL 2160 Botany 4

BL 2170 Zoology 4

#### Group B

BL 3400 Prin of Ecology 4

FW 3020 For & Landscape Ecol\* 3

Electives--8-9 cr

Choose a minimum of 6 credits from the following:

BL 3190 Evolution 3

BL 3400 Principles of Ecology\* 4

BL 4090 Tropical Island Biology 2

BL 4450 Limnology 4

FW 3020 Forest and Landscape Ecology\* 3

FW 3330 Soil Science 4

FW 4140 Ecosystem Modeling 3

FW 4220 Wetlands 4

FW 4610 Wildlife Ecology 3

Select remaining electives from the above elective list or the following:

BL 4130 Phycology 3

BL 4810 Plant Taxonomy 3

BL 5680 Bryology 4

FW 2010 Vegetation of North America\*\* 4

FW 3610 Ornithology 4

FW 3620 Field Ornithology 1

FW 4500 Independent Study 1-3

The following courses are recommended but are not part of the minor.

CH 1110 University Chemistry I 4

CH 1111 University Chemistry Lab I 1

CH 1120 University Chemistry II 4

\*These courses may not be double-counted as one of the required courses.

\*\*Only 2 credits of this class may count toward the minor

## **Economics Minor**

18 credits

### ***School of Business and Economics***

The Economics minor provides an understanding of how economies function, the foundation needed to examine economic issues associated with business, social, and governmental policies, and an exposure to areas where economics is applied to practical problems.

Required Courses--9 credits

EC 3001 Principles of Economics 3

Choose two of the following three courses

EC 3002 Microeconomic Theory 3

EC 3003 Macroeconomic Theory 3

EC 4200 Econometrics 3

Elective Courses--9 credits

Choose any three upper-division EC courses.

## **Electronic Materials Minor**

16 credits

### ***Department of Materials Science and Engineering***

Electrical engineers, computer engineers and physicists who plan careers in the electronic materials and device fabrication industries need a sophisticated understanding of materials in order to succeed. Most increases in computer speed, for example, have come from advances in materials processing operations in semiconductor fabrication plants. This minor addresses the needs of non-materials majors planning careers in these fields. The core course work covers the fundamentals of material structures, materials characterization methods, and electronic materials processing and design.

Required Courses--12 cr

MY 2100 Intro to Materials Science and Engineering 3

MY 3200 Materials Characterization I 4

MY 4700 Electronic Properties of Materials 2

MY 4710 Materials Science of Electronic Devices 3

Elective Courses--4 cr

Choose at least 4 credits from the following:

MY 3100 Materials Processing I 4

MY 3210 Materials Characterization II 4

MY 4200 Scanning Electron Microscopy 2

MY 4210 Diffraction 2

MY 4250 Practical Transmission Electron Microscopy 2

MY 4990 Undergraduate Research 1-3

PH 3480 Modern Physics Laboratory 2

PH 4510 Introduction to Solid State Physics 2

## **Enterprise Minor**

20 credits

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

The Enterprise Minor is a multidisciplinary experience, within which students run their own company and work on real-world problems in the context of an entrepreneurial venture. A major part of the experience includes a strong business and communication component in addition to the application of science, engineering, and technology to the solution of a design and/or business problem. Within the projects, the employees (students) solve problems, perform testing and analyses, build prototypes, manufacture parts (where appropriate), stay within budgets, make recommendations, and manage multiple timelines and projects.

### Required Courses

Choose one of the following:

- ENG 2961 Teaming in the Enterprises\* 2
- BA 2700 Business Problem Solving 4

### Required Courses

Choose a minimum of 6, maximum of 7, project credits from the following:

- ENG 1960 or ENG 2950 Enterprise Orientation 1
- ENG 2960 Enterprise Project Work I 1
- ENG 3950 Enterprise Project Work II 1
- ENG 3960 Enterprise Project Work III 1
- ENG 4950 Enterprise Project Work IV 2
- ENG 4960 Enterprise Project Work V 2

### Required Courses

Choose a minimum of 2\*\* communication credits from the following:

- ENG 2962 Communications Contexts\* 1
- ENG 3962 Communication Strategies\* 1
- ENG 4952 Complex Communication Strategies\* 1
- ENG 4953 Writing about Engineering in a Societal Context\* 1
- CM 3410 Technical Communications for Chem Engg\* 3
- HU 3120 Scientific and Technical Communications\* 3

### Required Courses

Choose at least 5 credits from the following:

- EC 3400 Economic Decision Analysis (or EC/ENG 3401, 3402, or 3403)\* 1-3
- EC 3001 Principles of Economics\* 3
- EC 3954 Enterprise Market Principles OR 1
- BA 3800 Principles of Marketing 3
- ENG 3961 Enterprise Strategic Leadership\* OR 1
- BA 4760 Strategic Leadership\* OR 3
- AF 3001 USAF Leadership Studies I\* 3
- ENG 3963 Enterprise Entrepreneurship OR 3
- BA 3780 Entrepreneurship 3
- ENG 3964 Scientific and Technical Communications\* 1
- BA 4610 Project Management 3
- ENG 3971 Seven habits of Effective People 1
- ENG 4951 Budgeting--Intrapreneurial Engineering (1) 1
- ENG 4954 Global Competition\* 1

### Required Courses

Choose remaining credits from the list below or above if not already used:

ENG2963 Electronic Circuit Design and Fabrication 1  
ENG 3955 Conceptual Design/Problem Solving 1  
ENG 3956 Industrial Health and Safety OR 1  
CM 4310 Chemical Process Safety/Environment 3  
ENG 3957 Product and Process Development I 1  
ENG 3958 Engineering Ethics in Design and Implementation OR 1  
CE 3331 Professional Practice 2  
ENG 3965 Material Flow in an Industrial Society 1  
ENG 3966 Design for Manufacturing 1  
ENG 3967 Product and Process Development II 1  
ENG 3968 Manufacturing Processes and Simulation 1  
ENG 3969 Project Phases of Design and Implementation 1  
ENG 4955 Concurrent Engineering and Project Data Management 1

\*May be used to satisfy General Education Distribution Course Requirements if not required by major.

\*\*Students completing BA 2700 are not required to complete any additional communication

## **Environmental Studies Minor**

18 credits

### ***Department of Social Sciences***

A minor in Environmental Studies emphasizes the social and political dimensions of environmental issues. It utilizes the disciplines of public policy, sociology, geography, anthropology, history, and ecology to explore the multifaceted aspects of contemporary environmental issues.

Required Courses--18 cr

Choose 6 of the following; at least four should be from Social Sciences:

BA 4790 Ecology Sustainability and Organizations 3  
BL 3400 Principles of Ecology 4  
EC 4600 Natural Resource/Environmental Economics 3  
FW 3110 Natural Resource Policy 3  
FW 3900 Conservation Biology and Ecology 3  
SS 2100 World Peoples and Environments 3

SS 3300 Environmental Problems 3  
SS 3410 World Resources and Development 3  
SS 3520 U.S. Environmental History 3  
SS 3630 Environmental Policy and Politics 3  
SS 3760 Human Dimensions of Natural Resources 3  
SS 3800 Energy Technology and Policy 3  
SS 3850 Environmental Toxicology & Society 3  
SS 3930 Environmental Issues 3  
SS 4000 Independ Study [readings or research on environ issues] 1-3

## **Ethics and Philosophy Minor**

18 credits

### ***Department of Humanities***

The minor in Ethics and Philosophy enables students to examine value issues in diverse professional and practical contexts such as biomedicine, communications, engineering, the environment, and politics. Students may also focus on philosophical questions about science and technology, as well as on traditional

problems in philosophy. The active cultivation of critical reasoning skills in each of these areas is emphasized.

Required Courses--3 cr

HU 2700 Introduction to Philosophy 3

Elective Courses--15 cr

Choose at least one course from the following:

HU 3710 Engineering Ethics 3

HU 3711 Biomedical Ethics 3

HU 4700 Topics in Philosophy 3

HU 4701 Political Philosophy 3

HU 4702 Environmental Philosophy 3

HU 4703 Issues in Communication Ethics 3

Choose at least one course from the following:

HU 2701 Logic and Critical Thinking 3

HU 3700 Philosophy of Science 3

HU 3701 Philosophy of Technology 3

HU 4700 Topics in Philosophy 3

HU 4701 Political Philosophy 3

HU 4703

Issues in Communication Ethics 3

In addition, students must take 3 optional courses from either elective list.

## **Geological Engineering Minor**

16 credits

*Department of Geological Engineering and Sciences*

Geological conditions are often critical factors influencing infrastructure and resource development projects. The geological conditions affect both the feasibility and design of projects in terms of both economic and public -safety considerations. An aptitude in applying scientific principles and engineering skills to solve problems influenced by geological conditions would be a valuable asset for professionals involved with such projects. A minor in geological engineering would provide a basic set of technical, practical skills in the investigation, assessment, and design of systems pertaining to the earth and its resources (petroleum, minerals, groundwater).

Required Courses--10 cr

GE 2400 Intro to Applied and Environ Geophysics 4

GE 3800 Earth Mechanics 3

GE 3850 Geohydrology 3

Elective Courses--6 cr

Choose a minimum of 6 credits from the following:

GE 3900 Field Geophysics 5

GE 4400 Near Surface Geophysics I 3

GE 4410 Near Surface Geophysics II 3

GE 4610 Formation Evaluation & Petroleum Engg 3

GE 4760 Engineering Evaluation of Mineral Deposits 3

GE 4800 Groundwater Engineering 3

GE 4810 Groundwater Site Investigation 3

GE 4820 Subsurface Remediation 3  
GE 4900 Geological Engineering Design Project I 3

## **Historical Studies Minor**

18 credits

### ***Department of Social Sciences***

A minor in Historical Studies emphasizes the archaeological and historical perspective on human society. Archaeology exposes students to the unwritten record and to prehistory, an essential component of historical thought. History provides insights on the past through the written record, and analysis of societal change and development.

Required Courses--18 cr

Choose 6 of the following courses

SS 2200 Prehistory and Archaeology 3  
SS 2500 American Experience 3  
SS 2550 Themes in Western Civilization 3  
SS 3200 Historical Archaeology 3  
SS 3210 Field Archaeology 2-8  
SS 3220 Archaeology Laboratory Methods 4  
SS 3230 Archaeology of Industry 3  
SS 3500 Modern American History 3  
SS 3505 Military History of the U.S. 3  
SS 3510 History of American Technology 3  
SS 3511 History of Science in America 3  
SS 3515 History of American Architecture 3  
SS 3530 The Automobile in America 3  
SS 3540 The History of Michigan 3  
SS 3541 The Copper Country 3  
SS 3550 Europe to 1650 3  
SS 3551 Europe in the Modern Era 3  
SS 3552 Renaissance & Reformation 3  
SS 3560 History of England I 3  
SS 3561 History of England II 3  
SS 3570 History of Canada 3  
SS 3580 Technology and Western Civ 3  
SS 3910 Histories & Cultures 3  
SS 3920 Topics in Archaeology 3  
SS 3950 Topics in American History 3  
SS 4000 Independent Study [readings or research on history topic] 1-3  
SS 4500 Historiography [alternate years] 3

## **International Modern Languages Minor**

### ***Department of Humanities***

International French Minor (21 cr)

International German Minor (21 cr)

International Spanish Minor (21 cr)

### **International French Minor**

21 credits

Students who want to earn an International Minor in French must complete two years of French (12 credits) and three courses (9 credits) chosen from 3000- or 4000-level course listed below which can be taken either at Michigan Tech or completed through study abroad.

In addition, students must spend at least 6 weeks for work or study in France or other French-speaking countries. The three elective credits in category B) may be earned through participation in an approved internship abroad.

Required Courses--12 cr (6 must be 3000 level)

HU 2271 Level 1-A French Language and Culture 3  
HU 2272 Level 1-B French Language and Culture 3  
HU 2273 Transitional Level I French Language and Culture 3  
HU 3271 Level II-A French Language and Culture 3  
HU 3272 Level II-B French Language and Culture 3  
HU 3273 Level II French Composition and Conversation 3

A. Elective Courses--6 cr

HU 3274 French Literature and Culture 3  
HU 3275 French for Special Purposes 3  
HU 3262 Topics in Francophone Culture 3  
HU 4271 Modern Language Seminar I-French: Language and Power 3  
HU 4272 Modern Language Seminar II-French: Individual and Society 3  
HU 4273 Modern Language Sem III-French: Tech in Literature and Film 3

B. Elective Courses--3 cr

BA4480 Global Finance 3  
BA 4680 International Technology Management 3  
BA 4710 International Management 3  
EC 3100 International Economics 3  
SS 3300 Environmental Problems 3  
SS 3400 Contemporary Europe 3  
SS 3410 World Resources & Development 3  
SS 3580 Technology & Western Civilization 3  
SS 3610 International Law 3  
SS 3620 International Technology Policy 3  
SS 3810 Culture, Science & Technology Policy 3  
SS 3890 Industry & the World Economy 3  
SS 3940 World Affairs 3  
UN 3002 Cooperative Laboratory coupled with 2  
HU 4060 Humanities Workshop 1

## **International German Minor**

21 credits

Students who want to earn an International Minor in German must complete two years of German (12 credits) and three courses (9 credits) chosen from 3000- or 4000-level course listed below which can be taken either at Michigan Tech or completed through study abroad.

In addition, students must spend at least 6 weeks for work or study in Germany or other German-speaking countries. The three elective credits in category B) may be earned through participation in an approved internship abroad.

Required Courses--12 cr

HU 2281 Level 1-A German Language and Culture 3  
HU 2282 Level 1-B German Language and Culture 3  
HU 3281 Level II-A German Language and Culture 3  
HU 3282 Level II-B German Language and Culture 3  
HU 3283 Level II German Composition and Conversation 3

A. Elective Courses--6 cr

HU 3284 German Literature and Culture 3  
HU 3285 German for Special Purposes 3  
HU 3263 Topics in German-Speaking Cultures 3  
HU 4281 Modern Language Seminar I-German: Language and Power 3  
HU 4282 Modern Language Seminar II-German: Individual and Society 3  
HU 4283 Modern Language Sem III-German: Tech in Literature and Film 3

B. Elective Courses--3 cr

See International Minor in French

## **International Spanish Minor**

21 credits

Students who want to earn an International Minor in Spanish must complete two years of Spanish (12 credits) and three courses (9 credits) chosen from 3000- or 4000-level course listed below which can be taken either at Michigan Tech or completed through study abroad.

In addition, students must spend at least 6 weeks for work or study in a Spanish-speaking country. The three elective credits in category B) may be earned through participation in an approved internship abroad.

Required Courses--12 cr (6 must be 3000 level)

HU 2291 Level 1-A Spanish Language and Culture 3  
HU 2292 Level 1-B Spanish Language and Culture 3  
HU 2293 Transitional Level I Spanish Language and Culture 3  
HU 3291 Level II-A Spanish Language and Culture 3  
HU 3292 Level II-B Spanish Language and Culture 3  
HU 3293 Level II Spanish for Special Purposes 3

A. Elective Courses--6 cr

HU 3294 Spanish Literature and Culture 3  
HU 3295 Advanced Spanish for Special Purposes 3  
HU 3264 Topics in Spanish-Speaking Cultures 3  
HU 4291 Modern Language Seminar I-Spanish: Language and Power 3  
HU 4292 Modern Language Seminar II-Spanish: Individual and Society 3  
HU 4293 Modern Language Sem III-Spanish: Tech in Literature and Film 3

B. Elective Courses--3 cr

See International Minor in French

Students may choose only one of the following courses:

HU 3501 Medieval Literature 3  
HU 3551 Renaissance Literature 3  
HU 3552 Restoration and Eighteenth Century Lit 3  
HU 3553 Nineteenth Century British Literature 3  
HU 3555 Twentieth Century British Literature 3

## **International Studies Minor**

18 credits

### ***Department of Social Sciences***

A minor in International Studies brings a global and comparative perspective to the study of culture, politics, history, and the environment. The focus is upon the histories and cultures of Europe and developing nations. Through study of comparative social systems and of the international dimensions of specific current issues, students will have a foundation for an examination of society and politics in the United States.

Required Courses--18 cr

Choose 6 courses from the following 3 groups:

SS 2100 World Peoples and Environments 3

SS 2550 Themes in Western Civilization 3

SS 3100 Developing Societies 3

SS 3300 Environmental Problems 3

SS 3400 Contemporary Europe 3

SS 3410 World Resources and Development 3

SS 3570 History of Canada 3

SS 3580 Technology and Western Civilization 3

SS 3610 International Law 3

SS 3620 International Technology Policy 3

SS 3810 Culture, Science, and Technology 3

SS 3890 Industry and the World Economy 3

SS 3910 Histories & Cultures 3

SS 3940 World Affairs 3

SS 3960 International Experience 3

SS 4000 Independent Study [readings/research on a topic concerning comparative history, culture, or politics] 1-3

Students may choose only one of the following courses:

SS 3550 Europe to 1650 3

SS 3551 Europe in the Modern Era 3

SS 3552 Renaissance & Reformation 3

SS 3560 History of England I 3

SS 3561 History of England II 3

Students may choose only one of the following courses:

FW 4520 Tropical Forests 3

HU 3502 World Mythologies 3

HU 3504 Novels from World Literature 3

HU 3910 Language in the World 3

## **Journalism Minor**

18 credits

### ***Department of Humanities***

The journalism minor prepares students to pursue the journalistic aspects of their chosen fields (e.g., gathering and reporting information) and to be better informed and more critical consumers of the news. The laboratory for the minor is Michigan Tech's award-winning student newspaper, the Michigan Tech Lode.

Required Courses--9 cr

HU 3605 Grammar and Usage in Society 3

HU 3621 Introduction to Journalism 3

HU 4703 Issues in Communication Ethics 3

Elective Courses--9 cr

No more than two chosen from all lists may be at the 2000 level.

Production Courses

At least one of the following--3 cr minimum

HU 2631 Fundamentals of Photography 3

HU 2650 Intro to Web Site Design 3

HU 3606 Editing 3

HU 3629 Practical Writing 3

HU 3630 Publications and Info Management 3

HU 3642 Introduction to Multimedia Dev 3

HU 4642 Special Topics in Advanced Media 3

Critical Perspective Courses

At least one of the following--3 cr minimum

HU 2820 Communication and Culture 3

HU 2920 Language and Society 3

HU 3151 The Rhetoric of Everyday Texts 3

HU 3261 Intercultural Communication 3

HU 3324 Visual Media Analysis 3

HU 3840 Organizational Communication 3

HU 3850 Cultural Studies 3

HU 3860 Popular Culture 3

HU 3910 Spec Topics in Linguistics: Language Issues in the World 3

HU 4625 Risk Communication 3

HU 4820 Modes of Comm: Oral, Print, Electronic 3

HU 4840 Communication and Global Culture 3

## **Mathematical Sciences Minor**

16 credits

*Department of Mathematical Sciences*

Students who wish to study mathematics beyond what is required for their major program may complete a minor in the Mathematical Sciences.

Required Courses--6-9 cr

Calculus

Select 1 course, 4-5 credit:

MA 1135 Calculus for Life Sciences 4

MA 1150 Calculus I 4

MA 1151 Calculus I Plus 5

MA 1160 Calculus with Technology I 4

MA 1161 Calculus Plus with Technology I 5

Linear Algebra or Calculus

Select 1 course, 2-4 credits:

- MA 2320/2321 Elementary Linear Algebra 2
- MA 2330 Honors Elementary Linear Algebra 3
- MA 2150 Calculus II 4
- MA 2160 Calculus with Technology II 4

Elective Courses--10 cr

Choose at least 10 credits numbered 3000 or above; 6 of these credits cannot satisfy a requirement for the student's major program, except as free electives.

Theory Core

a. Choose at least one course from the following:

- MA 3210 Introduction to Combinatorics 3
- MA 3310 Introduction to Abstract Algebra 3
- MA 3450 Introduction to Real Analysis 3
- MA 3924 College Geometry with Technology 3
- MA 4308/4908 Theory of Numbers 3
- MA 4330 Linear Algebra 3
- MA 4760 Mathematical Statistics I 3

b. Choose a second course from the above theory core list OR any 4000-level MA course (except MA 4945).

c. Choose any other 3000- or 4000-level MA course.

Note: Students who wish to complete a Teaching Certificate Minor in Mathematics, as part of their certification to teach high school mathematics, should see the entry under Secondary Teacher Certification Minor.

## **Microbiology Minor**

16 credits

### ***Department of Biological Sciences***

The courses within the minor in Microbiology constitute a selection which focus around environmental, ecological, organismal and medical aspects of the field of microbiology. Laboratories are an essential component of many of these courses.

Prerequisite Courses

- BL 1040 Principles of Biology 4
- BL 1060 Fundamentals of Biology 1
- BL 2100 Principles of Biochemistry 3

Required Courses--3-4 cr

- BL 3210 General Microbiology (with required prereqs of BL 2100, BL 1020 OR BL 1040) 4
- OR
- BL 3310 Environmental Microbiology (with required prereqs of either BL 1040 OR BL 1060) 3

Elective Courses

Choose courses to complete 16-cr requirement; 10 credits must be at 3000-level or higher.

- BL 3230 Medical Bacteriology 4
- BL 4000 Special Problems in Biology 1-3

BL 4130 Psychology 3  
BL 4220 Applied and Industrial Microbiology 3  
BL 4230 Virology 3  
BL 4740 Introduction to Mycology 3

## **Military Arts and Science Minor**

18 credits

### ***Department of Military Science (Army)***

Students of any major will greatly benefit in having a Military Arts and Science minor. Leadership, communication, team building, and problem solving are skills required for success in all careers. This minor will complement any major through a series of goal-oriented classes that will enhance the student's marketability.

Required Courses--14 cr

AR 3001 Small Unit Leadership Tactics 3  
AR 3002 Advanced Military Leadership Tactics 3  
AR 4001 Junior Officer Development Seminar 3  
AR 4002 Seminar in Leadership 3  
AR 4011 Battalion Staff Operations I 1  
AR 4012 Battalion Staff Operations II 1

Elective Courses--4 cr

Any Army ROTC Department courses not listed above and/or the following:

AF 2001 History of US Air/Space Power I 1  
AF 2002 History of US Air/Space Power II 1  
BA 3700 Organizational Behavior 3  
SS 3505 Military History of the United States 3  
SS 3600 American Foreign Policy

## **Mining Minor**

16 credits

### ***Department of Geological and Mining Engineering and Sciences***

Students who wish to have a background in the basics of mining without the requirements of a full engineering degree may opt for a Minor in Mining. This program is designed to acquaint the student with the core concerns of producing mineral resources in the modern world. Contact a Mining Engineering Department advisor to select the courses that fit your needs, beyond the required Introduction to Mining.

Required Course--4 cr

MG 2020 Intro to Mining Engineering and Mining Methods 4

Elective Courses--12 cr

Students must consult with a departmental advisor.

Any sequence of upper-division courses selected in consultation with an advisor from the Mining Engineering Dept. Students are responsible for satisfying all prerequisites.

## **Modern Languages Minor in French, German, or Spanish**

18 credits

Competing successfully in the world market requires language skills, cultural awareness, and international experience. The study of a modern language will help students address that challenge. In addition to gaining proficiency in the language and intercultural communication skills, students will also study literature and acquire knowledge of contemporary issues. A minor in a modern language can give students the competitive edge in their career and help them develop skills to cope effectively with the complex challenges of a rapidly changing global environment.

Students who want to earn a minor in either French, German, or Spanish must complete two years of the same modern language (12 credits) and two courses (6 credits) chosen from the language-specific 3000- or 4000-level courses listed or completed through study abroad. Three of the six elective credits may be earned through participation in an approved internship in a country of the target language.

Required Courses--12 cr\*

See International Modern Languages Minor requirements for corresponding language.

\*6 credits must be from 3000 level

Elective Courses--6 cr

See International Modern Languages Minor requirements for elective courses from group A of the corresponding language.

## **Music Minor**

16 credits

***Department of Fine Arts***

A minor in music adds breadth to the student's university experience and provides the student with in-depth experiences and understanding in music. Through studies in theory, appreciation, history, and performance, students will develop their musical abilities and will receive a foundation for music as a serious avocation. The minor allows the student to choose from three areas of focus: general music, music technology, and jazz idiom.

1. General Music Focus (16 credits) Students who complete a minor in general music will demonstrate a basic competency in music theory and history and a broad-based knowledge of various genres.

Required Courses--10 cr

FA 2500 Music Theory I\* 3

FA 3530 Music Theory II\* 3

FA 3560 Music History 3

FA 4970 Final Project\*\* 1

Elective Courses--6 cr

Choose 3 credits from the following:

FA 3550 History of Jazz 3

FA 3830 American Musical Theatre 3

FA 4950 Special Topics in Fine Arts 3

FA 4960 Special Topics: Workshop 3

Choose 3 credits from the following: \*\*

FA 2400 Huskies Pep Band 1

FA 2402 Campus Concert Band 1

FA 2420 Jazz Lab Band 1

FA 3400 Keweenaw Symphony Orchestra 1

FA 3401 Wind Symphony 1

FA 3420 R & D Jazz Band 1  
FA 3500 Gospel Choir 1  
FA 3510 Concert Choir 1  
FA 4400 Chamber Music Seminar 1

2. Music Technology Focus (16 credits) Students who complete a minor in music technology will gain a basic competency in music theory and history, a facility with MIDI instruments and with music notation and sequencing software.

Required Courses—

## **Physics Minor**

16 credits

*Department of Physics*

The physics minor provides for a broad background in all of the traditional areas of physics designed for those students who seek a firmer foundation in the most fundamental of the sciences. The increased knowledge in physics will benefit students in many different disciplines as they prepare for a life-long career in our ever-changing technological world. Not open to applied physics majors.

Required Courses--16 cr

PH 2100 University Physics I-Mechanics 3

PH 2200 University Physics II-Elec & Magnetism 3

Select at least 10 additional credits at the 3000 level and above, to include at least 1 of the following 3:

PH 3110 Theoretical Mechanics I 3

PH 3410 Quantum Physics I 3

PH 4210 Electricity and Magnetism 3

Of the 10 credits, at least 9 must be from courses not required for the student's major.

## **Plant Biotechnology Minor**

16 credits

*School of Forestry & Wood Products and Department of Biological Sciences*

This minor provides students an introductory understanding of the field of biotechnology with particular emphasis on plant biotechnology. Students majoring in fields impacted by biotechnologies --business administration, biomedical engineering, environmental engineering, chemical engineering, as well as chemistry and humanities--will benefit from this minor.

Required Courses--9 cr

BL 2100 Principles of Biochemistry 3

FW 3075 Plant Biotechnology 3

FW 4087 Molecular Genetics of Trees 3

Elective Courses--7 cr

Choose 7 credits minimum from the following:

BL 3210 General Microbiology 4

BL 4010 Biochemistry I 3

BL 4030 Molecular Biology 3

BL 4140 Plant Physiology 4

FW 4085 Tree Biotechnology 3

FW 4089 Plant Bioinformatics 3

FW 4120 Tree Physiology & Genetics 3  
FW 5050 Current Topics in Forest Biotechnology 3

Students are highly recommended to take 1-3 cr of Undergraduate Research (FW 4500 or BL 4000) in addition to the minor to gain hands-on experience. Permission of instructor is required.

## **Plant Sciences Minor**

16 credits

*School of Forestry & Wood Products and Department of Biological Sciences*

This minor provides students the opportunity to study and develop an understanding of the plant sciences and their role as a foundation of modern society. Open to all majors.

Required Course--4 cr  
BL 2160 Botany4

Elective Courses--12 cr

Choose at least 6 credits from the following:

BL 4130 Phycology 3  
BL 4140 Plant Physiology 3  
BL 4810 Plant Taxonomy 3  
FW 4087 Molecular Genetics of Trees 3  
FW 4110 Tree Seedling Production & Greenhouse Management 1-4

Select remaining electives from the above list or from the following:

BL 5680 Bryology 4  
FW 1035 Wood Anatomy and Properties\* 4  
FW 2010 Vegetation of North America\* 4  
FW 3020 Forest and Landscape Ecology 3  
FW 3075 Plant Biotechnology\* 3  
FW 4220 Wetlands 4

\* Only two credits from this course may count towards the minor.

## **Psychology Minor**

18 credits

*Department of Education*

This program is a broad curriculum designed to help students develop an understanding and appreciation of the lawfulness of human behavior. The psychology minor is designed to expose students to a range of perspectives, methodologies, and content areas. Students will find the minor program in psychology particularly relevant if they are planning to work in industry and business domains, educational settings, community agencies, medical settings, or other professional areas in which significant interaction with people is required. Students should note that some of the elective courses for a psychology minor might have their own prerequisites.

Required Courses--7 cr  
PSY 2000 Principles of Psychology 3  
PSY 4000 Experimental Methods & Statistics 4

Elective Courses--11 credits; 8 credits must be PSY  
ED 3112 Psychological Foundations of Learning & Seminar in Education 3  
PSY 2050 History and Systems of Psychology 3  
PSY 3010 Theories of Personality 3

PSY 3030 Abnormal Psychology 3  
PSY 3050 Developmental Psychology 3  
PSY 3060 Physiological Psychology 3  
PSY 3070 Cross-Cultural Psychology 3  
PSY 4010 Cognitive Psychology 3  
PSY 4050 Psychology of Science and Technology 3  
PSY 4080 Special Topics in Psychology 1-4  
PSY 4090 Indep Study in Psychology 1-3

## **Remote Sensing Minor**

16 credits

Interdisciplinary

Remote Sensing is measurement from a distance, sensing from afar. It uses the whole electromagnetic spectrum and is applied on a huge variety of scales, from microscopic to satellite or astronomical levels. It is used where direct sensing is impossible or difficult. Most of the remote sensing faculty have active research programs that require student workers and this experience is good professional training. The field is highly interdisciplinary and extremely broad and team based, including specialists in atmospheric physics and chemistry, biological and earth sciences, electrical engineering, forestry and ecology, civil, and environmental engineering, oceanography, limnology, image and signal analysis, astronomy and computer sciences. The Remote Sensing Institute has faculty from 9 different departments and has a number of advanced lab facilities as part of a NASA center of excellence.

Required Courses--4 cr

PH 3600 Introduction to Remote Sensing 2

UN 4000 Remote Sensing Seminar 1

[2 credits required]

Elective Courses--12 cr\*

Data Acquisition and Processing (3-6 cr):

EE 2150 Intro to Signal Proc

EE 3140 Electromagnetics

EE 4243 Physics of Microwave Devices

EE 4252 Digital Signal Proc

EE 4254 Image Proc

EE 5500 Statistical Signal Proc

EE 5520 Fourier Optics

FW 5560 Digital Image Proc: A Remote Sensing Perspective

FW 2230 Electronics for Scientists

FW 3210 Geometrical & Physical Optics

FW 5630 Imaging Sys

FW 5950 Grad Electronics for Scientists

Data Management (3-6 cr):

MA 4515 Intro to Partial Diff Equ

MA 4710 Regression Analysis

MA 3730 Survey Meth. & data Analysis

MA 4610 Numerical Linear Algebra

MA 5741 Multivariate Statistical Meth

MA 5980 Special Topics in Mathematics

CS 2090 Special Topics in CS

CS 4611 Intro to Computer Graphics

CS 3621 Intro to Computing w/Geometry

MA 5701 Statistical Methods  
GE 4160 Subsurface GIS  
CE 5661 GIS Applications  
FW 3540 Remote Sensing & Geo. Info. Systems in Natural Resource Management  
FW 5550 Geographic Info. Systems

Data Analysis and Applications (3-6 cr):

BL 5520 Satellite Limnology  
CE 3610 Hydrology  
CE 4501 Environ Engg Chem Proc  
CE 4504 Air Quality Engg & Sci  
CE 5505 Atmospheric Chem  
CE/CH 5509 Environ Organic Chem  
GE 2640/PH 2640 Intro to Meteorology  
GE 3300 Intro to Oceanography  
GE 4150 Natural Hazards  
GE 4170 Volcanic Clouds  
GE 4640/PH 4640 Meteorology  
GE 5150 Adv Natural Hazards  
GE 5160 Remote Sens of the Atmosphere  
GE 5170 Remote Sens of the Earth's Surface  
PH 5910 Atmospheric Physics

Independent Study/Senior Research classes (0-3 cr):

BL 4000 Spec Prob in Bio  
CE 4510 Baccalaureate Thesis  
CH 4990 Undergrad Res in Chem  
CS 4090 Spec topics in CS  
EE 4800 Spec Topics in EE  
FW 4500 Independ Study  
GE 4960 Independ Geol Engg Res  
MA 4990 Topics in Math  
PH 4080 Sr Res

\*No more than 6 hours at the 2000 level can be counted toward the minor.

## **State of Michigan Secondary Teacher Certification Minors** *Department of Education*

Biology--21-22 cr\*

BL 1040 4  
BL 2100 3  
BL 2160 4  
BL 2170 4  
BL 2200 3

Electives (3-4 cr):

BL 2010 3  
BL 3190 3  
BL 3210 3  
BL 3400 4

Chemistry--22 cr\*

CH 1110 4  
CH 1120 4

CH 2212 5  
CH 2410 3  
CH 2420 3  
CH 3510 3

Computer Science--20 cr\*

CS 1121 3  
CS 1122 3  
CS 2321 3  
OR  
CS 1131 4  
CS 1132 4  
AND  
CS 2141 3  
CS 2311 3

Electives (8-9 cr):

CS 3141 3  
CS 3421 4  
CS 3621 3  
CS 4121 3  
CS 4411 4  
CS 4421 3  
CS 4611 3

Earth Science--21 cr\*

GE 2000 3  
GE 2100 3  
GE/PH 2640 3  
GE 3300 3  
GE 3320 3  
PH 1600 2  
PH 1610 1

Electives (3 cr):

GE 2300 3  
GE 2310 3  
GE 2900 3  
GE 3000 3  
GE 4100 3  
GE 4150 3

Economics--24 cr\*

EC 3001 3  
EC 3002 3  
EC 3003 3  
EC 31003  
EC 3300 3  
EC 4000 2  
SS 2100 1

SS 2500 OR SS2600 3

English--21 cr\*

HU 3510 OR HU 3541 3  
HU 3512 3

HU 3540 3  
HU 3252 OR HU 4545 3  
HU 2548 3  
HU 4140 4  
HU 2830 OR FA2090 3

Mathematics--20 cr\*  
MA 1150 OR 1160 4  
MA 2150 OR 2160 4  
MA 2320 OR MA 2330 2 OR 3  
MA 3924 3  
CS 1010 OR CS 1121\*\* 3

Electives (3 cr):  
MA 2710 OR MA 2720 3 OR 4  
MA 2920 OR MA 2910 3  
MA 4908 OR MA 4308 3  
MA 1910 3  
MA 1920 3  
MA 1930 3  
MA 1940 3

Physics--22 cr\*  
PH 1100 1  
PH 1200 1  
PH 1600 2  
PH 2100 3  
PH 2200 3  
PH 2300 2  
PH 2400 2

Electives (8 cr):

additional PH courses at the 3000 level or above

Science--24 cr\*  
BL 1010 4  
BL 1020 OR BL 1040 4  
BL 2160 OR BL 2170 4  
CH 1110 4  
PH 1600 2  
PH 1610 1  
PH 2100 OR PH 1110 3  
GE 2000 3  
CH 1120 4  
(Labs must be taken in all classes, which have labs)

Social Studies--24 cr\*  
EC 3001 3  
SS 2600 3  
SS 3600 OR SS 3630 OR SS 3940 3  
SS 2550 3  
SS 2500 OR SS 3500 3  
SS 2100 3  
SS 3300 OR SS 3400 OR SS 3410 3  
EC elective 3

\*MTTC (Michigan Test for Certification) must be taken for all minors.

\*\* (CS 1010 or CS 1121 can be dropped if the Calculus with Technology series is taken, but you must take another 3-credit elective.)

## **Social and Behavioral Studies Minor**

18 credits

### ***Department of Social Sciences***

A minor in Social and Behavioral Studies focuses on the relationship between society, culture, and the individual in institutional life. It provides the non-major with basic tools to investigate the social causes and consequences of human behavior. The minor exposes the student to research, theory, and applications of social scientific knowledge of cultures, societies, group structures, and organizations, and how people think, behave, and interact within them.

Required Courses--18 cr

Choose 6 of the following courses

Students must select at least one of the starred (\*\*) courses:

HU 3261 Intercultural Communications 3

PSY 3070 Cross-Cultural Psychology\*\* 3

SS 2100 World Peoples and Environment 3

SS 2700 Introduction of Sociology 3

SS 2800 Science, Technology, and Society 3

SS 3100 Developing Societies [alternate years] 3

SS 3700 Industry and Society 3

SS 3710 Social Problems 3

SS 3720 Social Psychology\*\* 7

SS 3740 Sociology of the Family 3

SS 3750 Social Inequality [alternate years] 3

SS 3760 Human Dimensions of Natural Resources 3

SS 3810 Culture, Science, and Technology [alt years] 3

SS 3910 Histories and Cultures [on demand] 3

SS 4000 Ind Study [readings/res on social, cult, or behav theory] 1-3

SS 4010 Social Science Methods\*\* 3

## **Speech Presentation Minor**

19 credits

### ***Department of Fine Arts***

Upon completing a minor in presentation, students will be able to communicate effectively orally and to present their ideas adequately. This minor targets people entering any field that demands competency in oral presentation.

Required Courses--16 cr

FA 2090 Speech Communication 3

FA 2600 The Technique of Acting 3

FA 2660 Mainstage Theatre: Acting 3

FA 3090 Performance Communication 3

FA 3780 Directing for Theatre 3

FA 4970 Fine Arts Final Project 1

## **Structural Materials Minor**

16 credits

***Department of Materials Science and Engineering***

Mechanical, biomedical, civil, and chemical engineers in industry routinely require expertise in materials to succeed in their careers, for example materials selection for mechanical design; failure analysis; and materials processing issues in manufacturing. In most cases, the knowledge of materials must be learned on the job. This minor addresses the problem by exposing students to the fundamentals and practical aspects of structural materials, emphasizing relationships between material microstructure, processing, and mechanical performance in engineering components. The core course work provides a foundation in structural materials and materials selection, while there are a large number of elective choices that may be tailored to individual career goals.

Required Courses--9 cr

MY 2100 Intro to Materials Science and Engineering 3

MY 3400 Mechanical Properties of Materials 3

MY 4800 Materials and Process Selection in Design 3

Elective Courses--7 cr

Choose 7 credits minimum from the following:

BE 3500 Biomedical Materials 3

CE 3101 Civil Engineering Materials 3

CM/CH 4610 Intro to Polymer Science 3

MY 3200 Materials Characterization I 4

MY 3210 Materials Characterization II 4

MY 4130 Principles of Metal Casting 3

MY 4140 Ceramics and Powder Materials 3

MY 4150 Composite Materials 2

MY 4160 Corrosion and Environmental Effects 2

MY 4170 Materials and Energy in Society 2

MY 4400 Deformation and Forming of Materials 4

MY 4990 Undergraduate Research 1-3

**Technical Theatre Minor**

19 credits

***Department of Fine Arts***

A technical theatre minor enhances students' technical expertise by introducing an artistic component with an emphasis in theatre production through practical experience. It also provides an opportunity for students to use their technical orientation in other fields in an artistic context. Students will be able to demonstrate developed creative problem-solving skills and artistic skills in theatrical and non-theatrical design fields.

Required Courses--19 cr

FA 1700 Technical Theatre Production 3

FA 2661 Mainstage Theatre: Crew 3

FA 2820 Theatre Appreciation 3

FA 3700 Scenic Design 3

FA 3750 Lighting Design 3

FA 3780 Directing for Theatre 3

FA 4970 Fine Arts Final Project 1

**Theatre Arts Minor**

19 credits

## ***Department of Fine Arts***

The study of theatre adds breadth to the students' general university experience and depth to the students' studies in science, technology, and engineering. Students with a minor in theatre will have developed their creative, visual, and presentation skills; will understand the elements and principles of theatre; will have an understanding of the history of civilization through their study of theatre history and drama; and will have the tools and incentives for life-long learning.

Required Courses--13 cr

FA 2600 The Technique of Acting 3

FA 3700 Scenic Design 3

FA 3780 Directing for Theatre 3

FA 3800 Dramatic Literature 3

FA 4970 Fine Arts Final Project 1

Elective Courses--6 cr

Choose 3 credits from the following:

FA 2660 Mainstage Theatre: Acting 3

FA 2661 Mainstage Theatre: Crew 3

Choose 3 credits from the following:

FA 3810 Ancient Theatre History 3

FA 3830 American Musical Theatre 3

## **Engineered Wood Products**

16 credits

### ***School of Forestry & Wood Products***

Wood is the single-most important industrial raw material in the world. The wood science minor will provide you with a basic knowledge of wood and engineered wood composite properties; industrial processing and manufacturing methods; and all types of wood products and will benefit your future career in engineering, forestry, business, or other fields.

Required Courses--13 cr

FW 1035 Wood Anatomy and Properties 4

FW 3080 Engineered Wood 4

FW 3082 Solid Wood Products 3

FW 3098 Mill Tour and Seminar 2

Elective Courses--3-4 cr

Choose one course from the following:

BA 2100 Business Statistics 3

BA 3600 Quality Management 3

CE 2201 Structural Engineering I 3

EC 3400 Economic Decision Analysis 3

EC 4600 Natural Resource and Environmental Economics 3

FW 3010 Practice of Silviculture 3

MA 2720 Statistical Methods 4

MA 3710 Engineering Statistics 3

MEEM 2150 Mechanics of Materials 3

MY 2100 Introduction to Materials Science and Engineering 3

